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ALLERGY OF THE UPPER AND LOWER RESPIRATORY TRACTS IN CHILDREN*

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In the diagnosis and treatment of respiratory allergy in children a close cooperation between the otolaryngologist and the pediatric allergist is most important. In many instances diagnosis depends primarily upon the findings and opinion of the otolaryngologist. The following observations are based upon a study of 455 cases seen in the Pediatric Allergy Clinic of Washington University. These investigations have extended over a period of eight years.

The types of cases referred to this clinic consisted of patients with perennial nasal allergy, hay fever or asthma or a combination of such manifestations. In addition many patients with a history of frequent colds, bronchitis, questionable asthma or sinusitis were also studied. Particular attention was paid to those patients with these complaints who had or had had other manifestations of allergy such as eczema, urticaria, angioneurotic edema, gastro-intestinal allergy or allergic headache.

The otolaryngologic investigation consisted of a careful analysis of (1) the nasal symptoms of sneezing, itching, discharge and obstruction; (2) the gross nasal changes; (3) the cytology of the

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secretions; (4) the x-ray findings; and (5) the bacteriologic findings. Of all these diagnostic factors the demonstration of eosinophiles in the nasal and sinus secretions was considered the most positive sign. By cytologic studies it was also possible to determine the clinical course of the disease in relation to acute, subacute and chronic complicating infection.

The demonstration of a certain number of eosinophiles in the secretions was considered necessary as an indication of positive diagnoses in all cases. By this plan of study the questionable cases could definitely be classified. Patients were frequently observed with an acute cold at the first visit, during which time it was often not possible to establish a definite diagnosis.

An analysis of the total group of 455 cases is shown in Table I. It will be noted that they were classified as perennial nasal allergy, 52 or 15.2 per cent; hay fever, hay fever and nasal allergy, and hay fever, nasal allergy and asthma, 129 or 37.8 per cent; and nasal allergy and asthma, 160 or 47 per cent—a total of 341 patients with respiratory allergy. The remaining group of 114 cases consisted of those patients who were suspected but did not prove to have respiratory allergy. Forty-four of these patients had other manifestations of allergy but no respiratory allergy. Seventy patients with colds, bronchitis or sinusitis also did not prove to have respiratory allergy.

On the basis of the clinical history, the physical examination and the skin tests the types of respiratory allergy were definitely classified into the groups as referred to above. On the basis of cytologic studies we were able to determine the incidence and severity of sinus infections and to establish certain indications for tonsillectomy.

TONSILLECTOMY AND RESPIRATORY ALLERGY

In view of the similarity of the symptoms of respiratory allergy and colds, bronchitis and sinusitis, a definite primary diagnosis is often not established in the management of these cases. The diagnosis of some types of respiratory infection is often made with the advice of removal of the tonsils and adenoids. In the analysis of the group of 455 cases herein discussed it is apparent that a consideration of tonsillectomy was frequently the primary factor. The incidence of the various types of respiratory allergy which we observed was greatly influenced by this factor alone. We feel that many patients with respiratory allergy, especially perennial nasal allergy and hay fever, are subjected to this operation without the recognition of the allergic manifestations. In the series of 341 cases of respiratory allergy we

feel that the incidence of pure nasal allergy is too low, and the incidence of hay fever, hay fever and nasal allergy, and asthma is too high. Patients with frank bronchial asthma are easily recognized as such but the other types are frequently overlooked.

TABLE I

ANALYSIS OF 455 CASES FROM PEDIATRIC ALLERGY CLINIC

	Nasal Allergy	Hay Fever, Hay Fever and Nasal Allergy, Hay Fever Nasal Allergy and Asthma	Nasal Allergy and Asthma	Total	Allergic No Resp. Allergy	Colds Bronchitis Sinusitis
	52, 15.2%	129, 37.8%	160, 47%	341	44	70
TONSILS AND ADENOIDS						
Tonsils present	27	59	100	186, 54.5%	30	31
Removed before admission to clinic	12	39	27	78, 22.9%	6	15
Removed in clinic before admission to allergy clinic	10	20	21	51, 15.0%	6	8
Removed after observation in allergy clinic	3	11	12	26, 7.6%	2	16
	52	129	160	341	44	70

Although there are definite indications for tonsillectomy in a great many patients with respiratory allergy, this operation should not be performed primarily for the relief of allergic symptoms.

Among the 52 patients with nasal allergy in Table I, it is noteworthy that in 12 the tonsils were removed previous to observation in the clinic and in 10 the tonsils were removed in the clinic before being observed in the allergy clinic. From the clinical histories it was evident that in these 22 cases the diagnosis of respiratory allergy had not been established previous to operation.

Among the 129 patients with hay fever, hay fever and nasal allergy, and hay fever, nasal allergy and asthma, tonsillectomy had been performed in 59 patients before coming under our observation. In the nasal allergy and asthma group 48 of 160 patients had had their tonsils removed but the percentage of cases is much smaller,

as the asthma was often recognized early. On the other hand, early asthma may be manifested only as cough and may therefore be overlooked.

In the entire group of 341 patients with respiratory allergy it is noteworthy that a tonsillectomy was performed in only 26 or 7.6 per cent after observation in the allergy clinic.

Among the 44 allergic patients with no respiratory allergy only 12 had been subjected to tonsillectomy. Among the 70 nonallergic patients with colds, bronchitis or sinusitis, 23 had had the tonsils removed previous to our observation and in 16 the operation was advised after the possibility of existing respiratory allergy was ruled out.

In the allergic group with no respiratory allergy and the colds, bronchitis and sinusitis group, consisting of 114 patients, there were many suspected of having respiratory allergy who were not observed for a sufficiently long period of time to establish a definite opinion as to whether or not respiratory allergy was present.

In the final analysis of these statistics it is apparent that tonsillectomy is often performed to relieve the symptoms of allergy which are apparently considered primarily of infectious origin. That this contention is true was well established by an analysis of a group of routine patients who entered the clinic during the summer of 1938 for a consideration of removal of the tonsils and adenoids. Two hundred such patients were specifically studied to determine the incidence of respiratory allergy among them. These patients were observed during July, August and September, 1938. Of the 200 patients, 104 were male and 96 female. The ages varied from 3 to 16 years. Among the 200 patients, 26 proved to have nasal allergy, an incidence of 13 per cent. Of the 26 positive cases the local nasal symptoms were typical in only 13 instances. The complaints in all 26 cases are listed as follows in Table II.

TABLE II
COMPLAINTS AND SYMPTOMS OF POSITIVE CASES

Nasal obstruction, discharge, sneezing, itching of nose, etc.	10
Headache	2
Sore throat and sneezing	1
Frequent upper respiratory infection	1
Nasal obstruction and discharge	9
Sore throat	2
Swollen cervical gland	1
Total	26

A positive family history of allergy was noted in 11 or 42 per cent of the 26 cases, as follows: asthma, six; hay fever, three; asthma and hay fever, one; and nasal allergy, one.

A positive (past) history of other manifestations of allergy preceding the onset of nasal symptoms occurred in five instances. Three patients had urticaria and two had eczema.

In the local examination of the nose it is noteworthy that only 14 or 54 per cent of the positive cases showed the typical pallor or edema of the nasal mucosa. It is apparent, therefore, that diagnosis often cannot be established on the basis of the local changes. In the 26 positive cases the final diagnosis was confirmed upon the demonstration of eosinophiles in the nasal secretions. It is also noteworthy that six of the 26 patients had hay fever—three grass and three ragweed.

Among the group of 174 negative cases a positive family history of allergy was noted in 43 or 24.7 per cent. A positive past or present history of other allergy was present in 18 instances as follows: urticaria 14, eczema three, and eczema and urticaria one. In these patients with other manifestations of allergy it is important to keep them under observation from time to time for the possible development of respiratory allergy. This is especially true in very young children, as respiratory allergy may be precipitated after an acute infectious disease, especially pertussis.

Although tonsillectomy is indicated in certain patients who have nasal allergy, it is important to bear in mind that this procedure will not materially influence the allergic symptoms except in a small percentage of cases. The indications for tonsillectomy in children with nasal allergy should be the same as in those without nasal allergy. In any event tonsillectomy should be performed only after allergic study. In children with nasal allergy it is hardly possible to determine the incidence of infectious colds unless repeated clinical observations are made over a period of one to two years, during which time the cytology of the nasal and sinus secretions is correlated with the history and physical findings. Our observations on allergic children show that the highest incidence of colds occurs during the ages of 6, 7, and 8 years. It has been our experience that the majority of allergic children do not have more than the normal number of colds, and that sinusitis is not a common complication.

ROENTGENOGRAPHIC STUDIES OF THE SINUSES IN ALLERGY
AND IN INFECTION

In view of the fact that edema of the mucosa of the sinuses is commonly present with nasal allergy, positive findings are the rule rather than the exception. The plates should not be taken during a period of acute exacerbation or during an acute or subacute infection for the findings will be very much more pronounced than during a quiescent stage. The cytology of the secretions may be relied upon to determine whether recent infection is present. If it is determined that infection is present the x-ray examination should be correlated with the cytology and the bacteriologic examination of the secretions obtained from the antrums, for example, after puncture, aspiration and washing.

In this series of 341 cases of respiratory allergy an x-ray examination was made in 81 instances, in five of which the sinuses were clear (Table III). In 14 cases the sinuses were punctured and irrigated and in nine cases an antrum window operation was performed.

Among 44 allergic patients who had no respiratory allergy, cloudy sinuses were noted in six instances and in two cases irrigation of the sinuses was negative.

Among 70 patients with colds, bronchitis, or sinusitis the sinuses were x-rayed in 22 cases, in 20 of which they were cloudy and two of which they were clear. In six patients an antrum window operation was performed.

From these studies it is evident that infection of the sinuses is not a common complication of respiratory allergy as generally believed and as generally reported in the literature. Among the numerous reports in the literature on the subject of sinus disease in children, allergy is not given due consideration as an etiologic factor. From a review of the symptoms, nasal changes, character of the secretions and x-ray findings it is evident that a high incidence of allergy must be present. Yet it is quite impossible to evaluate many reports because allergy is not considered, and because cytologic and bacteriologic findings are not reported. A clear general understanding of sinus disease in children will not be forthcoming until allergy is given due consideration and until sinus disease is discussed in terms of cytologic findings as well as in terms of other diagnostic procedures.

TABLE III

X-RAY OF SINUSES

Allergic, 341 Cases

One Antrum Cloudy	8
Both Antrums Cloudy	65
Both Antrums and Frontals Cloudy	3
Sinuses Clear	5
	<hr/>
	81

Antrum Irrigation

Clear	6
Mucus	3
Pus	5
	<hr/>
	14

Antrum Window Operation	9
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ALLERGIC—NO RESPIRATORY ALLERGY

44 Cases

Both Antrums Cloudy	3
One Antrum Cloudy	3
	<hr/>
	6

Antrum Irrigation, negative	2
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COLDS, BRONCHITIS, SINUSITIS

70 Cases

One Antrum Cloudy	1
Both Antrums Cloudy	14
Both Antrums and Frontals Cloudy	5
Sinuses Clear	2
	<hr/>
	22

Antrum Window Operation	6
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THE CYTOLOGY OF THE SECRETIONS IN ALLERGY OF THE
NOSE AND PARANASAL SINUSES

It has already been pointed out that, in the various shock organs or tissues in which the lesion of allergy occurs, the pathologic picture is characterized by edema and eosinophilic infiltration. In the nasal, paranasal sinus, bronchial, conjunctival, intestinal and genito-urinary tissues the eosinophiles migrate through the epithelium and may be found in the secretions. The demonstration of these cells in the secretions, therefore, may be utilized as a means of corroborating the diagnosis of allergy.

The earliest recorded description of eosinophiles was made by Warthin Jones¹ in 1846. A few years after the demonstration of Charcot-Leyden crystals in bronchial secretions in asthma by Leyden² in 1872, Ehrlich³ in 1879 described and named these leucocytic cells with acidophile granules, "eosinophiles." In 1887, Bizzozero⁴ described Charcot-Leyden crystals in the nasal secretions and called attention to the possible relationship of these crystals to the granules of eosinophile cells. This observation was confirmed by several authors, the most outstanding of whom were Gollasch⁵ (1889), Schmidt⁶ (1891), Lewy⁷ (1891), Wright⁸ and Neusser⁹ (1892). They emphasized the finding of eosinophilic infiltration and edema in the tissues and the demonstration of eosinophiles in the nasal secretions in cases of bronchial asthma, nasal polyps, and spasmodic coryza. In 1895, Seiffert and Kahn¹⁰ illustrated by means of color plates the edema and eosinophilic infiltration in edematous polyps and in the nasal and paranasal sinus tissues in so-called acute and chronic catarrhal rhinitis and sinusitis. Since these primary observations on the demonstration of eosinophiles in the bronchial secretions, a great deal of significance has been attributed to these findings in asthma. Following the period of these earliest observations up until only a few years ago, however, these important and significant pathologic findings in the nose and paranasal sinuses either were not recorded or received no more than passing mention. Even in cases of frank nasal allergy described by the terms nasal hydrorrhea, nasal neurosis, paroxysmal or spasmodic coryza, vasomotor or hyperesthetic rhinitis, the significance of edema and eosinophilic infiltration of the tissues and the presence of eosinophiles in the usual secretions was not given consideration. During the twenty-five-year period from 1895 to 1920 there was much controversy resulting in divergent opinions regarding the origin, pathology, and significance of nasal polyps, and yet edema and eosinophilic infiltration of the

tissues or the presence of eosinophiles in the nasal secretion was not considered. The most popular opinion and belief regarding nasal polyps was that infection is the chief etiologic factor.

The classification of the inflammatory diseases of the paranasal sinuses which has been recognized since the beginning of rhinology as a specialty, until recently divided the various affectations into three main classes: (1) the suppurative; (2) the nonsuppurative, or hyperplastic; and (3) the combined suppurative-hyperplastic diseases. This classification, however, did not recognize or distinguish the hyperplastic or polypoid diseases of allergic origin, but it is apparent that they were included in the nonsuppurative and combined suppurative-hyperplastic groups. During the past few years the reports of Finck,¹¹ Mullin and Ball,¹² Hansel,^{13, 14, 15} Coates and Ersner,¹⁶ Weille,¹⁷ Shambaugh,¹⁸ Rackemann and Tobey,¹⁹ Walsh and Lindsay,²⁰ Eggston,²¹ Schall,²² Semenov,²³ and others^{24, 25, 26} on the pathologic significance of edema and eosinophilic infiltration of the nasal and paranasal sinus tissues have shown that allergy plays an important and integral part in the diagnosis and treatment of the diseases of the nose and paranasal sinuses. The reports of Eyer-mann,²⁴ Leichner,²⁵ Hansel,¹⁵ Tillotson,²⁶ Sewall and Hunnicutt,²⁷ Kahn and Stout,²⁸ Johnson and Goldstein,²⁹ Lindsay and Walsh³⁰ on the significance of eosinophiles in the nasal and sinus secretions have emphasized the importance of considering the cytology as an aid in the diagnosis of allergy.

The revival and recognition of these pathologic findings have thrown renewed light upon the diagnosis and treatment of paranasal sinus disease and have emphasized the necessity of a reclassification of the inflammatory diseases of the paranasal sinuses. It is now apparent that practically all the nonsuppurative hyperplastic or polypoid diseases and many of the combined suppurative-hyperplastic diseases are of allergic origin. We must now consider the so-called inflammatory diseases of the paranasal sinuses as being (1) of infectious or suppurative origin; (2) of allergic origin; or (3) of allergic origin with superimposed infection.

By the comprehensive correlation of the clinical picture with the histopathologic examination of the tissues, there should be no difficulty in establishing a definite diagnosis of paranasal sinus disease. It is not always practical, however, to perform a biopsy of the tissues, but the cytology of the nasal and sinus secretions may be considered an approximate index of the pathologic process occurring in the tissues. The cytologic findings, therefore, give important diagnostic information.

Whenever a patient is referred by the allergist or the internist, the otolaryngologist should be capable of determining the presence or absence of the manifestations of allergy, and he should be able to determine whether infection complicates an existing nasal allergy. Cases of headache and gastrointestinal disease of allergic origin often have mild or atypical nasal manifestations and these should be recognized by the otolaryngologist. The rhinologist bases his diagnosis chiefly upon the clinical history, the nasal changes, the roentgenography of the sinuses, the bacteriology, the cytology of the secretions, and the histopathology of the nasal and paranasal sinus tissues.

The following considerations on the cytology of the nasal and sinus secretions in allergy are based upon the observations of about 10,000 specimens of secretion from about 2,000 cases of nasal allergy in adults and children, associated in many instances with other manifestations of allergy, especially bronchial asthma. These observations were made over a period of about 15 years, and many of the patients were repeatedly observed for several years during this time. The cytologic findings were correlated with the clinical histories, the skin tests, the x-rays of the sinuses, the bacteriology, the biochemistry of the secretions, the histopathology of the tissues, and other laboratory data, in order to make practical interpretations of the cellular reactions in the secretions. The correlation of the cytology with these findings is therefore of absolutely indispensable value in diagnosis.

PREPARATION OF SMEARS

It is often quite impossible to draw conclusions from the examination of a single smear of secretion; therefore it may be necessary to make an examination of several smears, especially if the specimen does not contain sufficient material or if acute or chronic infection complicates the picture. In the collection of secretion from the nose for smear examination, several methods may be employed. Specimens may be taken separately from each side of the nose. Secretion is most easily and readily collected by having the patient blow the nose on a waxed paper or cellophane handkerchief. This gives a specimen which represents only nasal secretion or a collection of both nasal and sinus secretion. Small crusts from the septum and vestibule of the nose should be avoided. If no secretion is available from blowing the nose, it may be necessary to remove it by swabbing it with a cotton applicator. Secretion may also be collected in a specimen bottle at the time of an acute exacerbation. It may be necessary to centrifuge. A small mass of mucus selected from the specimen, however, may be satisfactory. The insertion of a saline

tampon into the nose may stimulate the flow of secretion so that sufficient material may be obtained. Secretion from the individual sinuses may be obtained by aspiration or by puncture and washing. Gross masses of secretion may be used for smears or the returned fluid may be centrifuged if no gross mass of material is available.

When a patient reports for observation during or following a period of acute exacerbation of symptoms, the question frequently arises as to whether the reactions were the result of allergy or the result of an acute infection. Sometimes the history suggests the nature of the reactions and sometimes it is quite impossible to determine without the examination of the secretion for the cellular response. The color or consistency of the secretion is frequently not an index of the cytologic contents. Clear secretion may contain many eosinophiles or many neutrophiles, or it may contain varying proportions of both types of cells. Yellowish secretion usually contains a marked predominance of neutrophiles but may contain a marked predominance of eosinophiles.

TECHNIC OF STAINING SMEARS

The staining technic used for preparing the smears for examination is the same as that used for blood smears. Smears should be fixed by the application of methyl alcohol (National Aniline and Chemical Co.). We have used Wright's, Giemsa's and methylene blue and eosin stains, but have found that the latter stain is the most satisfactory. Giemsa stain may be used when a large number of smears are stained at one time, each individual slide does not require the exacting technic as with the Wright method. Eosinophile granules stain a brownish-red color and the nucleus stains blue. Neutrophiles show a clear violet cytoplasm with a deep blue nucleus. Giemsa stain is made fresh at the time of use. One drop of stain is diluted with 1 cc. of neutral distilled water. It requires about 1.5 cc. of stain for each slide, which should be fully flooded. The stain should be allowed to remain on the slide about twenty-five or thirty minutes, when it should be poured off and the slide gently flooded with neutral water. Then a few drops of ethyl alcohol should be flooded on the slide to clear off excess stain. If the slide is stood on end on filter paper, it drains and dries within a few minutes and is then ready for the microscopic examination.

In order to obtain the most satisfactory staining of the secretions, neutral water must be prepared fresh each day. Do not use a rubber connection on the stock bottle of distilled water. One

drop of 1 per cent potassium carbonate per 50 cc. of distilled water will be sufficient for neutralization. If it is necessary to neutralize acid water, use 1 per cent hydrochloric or acetic acid solution. It is advisable, however, to use an indicator. For this purpose we have found hematoxylin crystals most satisfactory. With a pair of metal forceps a few crystals of hematoxylin are placed in a glass test tube. The tube should be clean with no traces of acid or alkalies. Add about 5 cc. of the water to be tested and shake. The color of the water will change to either yellow or pink, or a deep purple. If it turns pink within two to five minutes, the water is neutral. If it becomes pink before one or two minutes, the water is alkaline. If it remains yellow for five minutes or longer, it is acid.

Rapid Giemsa Stain. When an immediate examination of a smear is desired the rapid Giemsa method may be employed. The technic is the same with the exception of the stain mixture and the time element. A stock bottle of stain should be prepared by mixing equal parts of the regular Giemsa stain with pure methyl alcohol. Then a mixture for immediate staining is made by mixing an equal part of this stain mixture with neutral distilled water. Flood the slide completely and allow to stain for one minute. Then use the neutral water and the ethyl alcohol as above.

IMPROVED TECHNIC OF STAINING NASAL AND BRONCHIAL SECRETIONS

For the staining of nasal, ocular and bronchial secretion smears we have, for some time, employed the Wright and the Giemsa methods as used for blood smears. Because of the variations in the pH, minerals and viscosity of secretions, these stains have proved to be very inconsistent. An attempt was made, therefore, to develop a technic which would give consistently good, well-stained preparations. Eosin and methylene blue were found to be very satisfactory, provided the specimen was stained with each separately, using the eosin first and the methylene blue last.

STAINS

The stain should be certified by the Commission of Standardization of Biological Stains. The National Aniline and Chemical Company makes good stains and pure methyl alcohol. The methyl alcohol should be fresh and the prepared stains should not be kept more than two months.

PREPARATION OF STAINS

Eosin.—Dissolve 0.30 gm. of eosin in 60 cc. of methyl alcohol (National Aniline). 1-200 solution.

Methylene Blue.—Dissolve 0.30 gm. of methylene blue in 60 cc. of methyl alcohol. 1-200 solution.

TECHNIC OF STAINING

1. The secretions should be well teased out on the slide so as not to be too thick.

2. Dry in air or gently over flame.

3. Draw a mark in front of label with paraffin pencil to prevent soiling of label.

4. Stain for one minute with the eosin solution, 1-200.

5. Add distilled water, enough to take up the staining solution and to cover the slide completely, as in the Wright technic. Allow to stand for one minute. Then drain off and flood with distilled water until all free stain is removed. Flood with 95 per cent ethyl alcohol and drain off. Then immediately,

6. Stain with methylene blue solution, 1-200, for ten seconds. Add distilled water to cover slide as above and let stand thirty seconds. Then remove excess stain with distilled water and finally the ethyl alcohol as above. If the neutrophiles do not stain well, restain with the methylene blue as above. If the secretion is thick and tenacious and there is a large number of neutrophiles, they may not completely stain. They may therefore show a pink color, in which case they should not be mistaken for eosinophiles. Diffuse uniform pink areas in thick secretion usually indicate incomplete methylene blue staining.

If the mucus or the neutrophiles are too intensely blue, excess stain may be removed by flooding the slide with a weak acid solution; one drop of 1 per cent hydrochloric acid to one ounce of distilled water. The solution should be left on for only a moment, then quickly poured off. Then flood the slide with pure distilled water and finally the ethyl alcohol.

The eosinophiles will stain with a brilliant red cytoplasm with easily recognizable granules and the nucleus will stain blue. The neutrophiles and epithelial cells will stain with a deep blue nucleus

and lighter blue cytoplasm. The mucus will stain blue. In general the intensity of the stains may be controlled by varying the concentration of the stains or the time element.

EXAMINATION OF SMEARS

Thick, grossly visible areas on the slide may be examined first with low power and then with high power or oil immersion. For the most satisfactory interpretation of cytologic pictures a magnification of 125 to 150 should be used. With these magnifications the cells can be readily recognized and yet one has the advantage of viewing the largest possible field. Interpretation depends upon determining the numbers and proportions of cells present. With the above magnification the field will be about 1 mm. in diameter. For high power examination balsam and a cover slip should be applied.

INTERPRETATION OF SMEARS

In the interpretation of the cytology of the secretions, one must take into consideration the type and quantity of secretion in the specimen and correlate the findings with the clinical history and nasal changes. The clinical type of allergy under consideration and the possible relationship of acute and chronic infection must always be evaluated. An appreciation of the significance of the cytology of secretion can be accomplished only by individual experience, and then only after the examination of many hundreds of specimens. If this work is done by a laboratory or by a technician, the clinician sacrifices the real value of the cytologic findings, for individual interpretation must be correlated with all the clinical facts.

In the inspection of a smear, one containing only eosinophiles, for instance, it will be noted that the cells are irregularly distributed. Sometimes they are scattered, arranged in clumps or arranged in streaks (Figs. 1, 2 and 3). When mixed with neutrophils, they may likewise be irregularly distributed (Figs. 2, 4). Only certain parts of the slide may show significant areas. It is not unusual, for instance, to find a slide completely covered with neutrophils except in certain small areas where eosinophiles are clumped in masses (Fig. 4).

In recording the cytologic findings, the question arises as to what percentage of eosinophiles constitutes a diagnostic number. In view of the irregularity of distribution, it is quite impossible to make an accurate evaluation in terms of percentages. One can learn only by individual experience how to evaluate the cytology. In making

TABLE IV

INTERPRETATION OF CYTOLOGIC PICTURES

E+— E+ E++ E+++ E+++++

Pure allergic cytologic pictures with no complicating infection. Number of eosinophiles varies according to cell dilution or concentration in thin, moderately thick or very thick secretion or according to clumps.

N+— N+ N++ N+++ N+++++

Normal or infectious cytologic pictures with no eosinophiles. N+— and N++ normal or quiescent stage. N+++ may be onset or end stage of a cold. N++++ and N+++++ acute, subacute or chronic infection. May be noted in allergic as well as in normals.

E+—
E+
E++
E+++
E+++++

N+
N+
N+
N+
N+

E+—
E+
E++
E+++
E+++++

N++
N++
N++
N++
N++

E+—
E+
E++
E+++
E+++++

N+++
N+++
N+++
N+++
N+++

E+—
E+
E++
E+++
E+++++

N+++
N+++
N+++
N+++
N+++

Allergic pictures with mild secondary infection, usually caused by obstruction of nasal respiration.

Allergic pictures with secondary infection — stagnation caused by marked nasal obstruction. May be onset or end stage of an infection.

Marked infection. E+—, N++++ not diagnostic of allergy, may be observed in normals as well as allergics. E+, N++++, allergic individual with an infection. E++, N++++, E++++, N++++, onset or end stage of an acute infection in allergic individual.

Same as Group III.



Fig. 1—E+

Small clump of eosinophiles, diagnostic of nasal allergy. Clumps of this type often noted in thin watery secretion.

a record of the cytologic findings on the history, the best method is the use of the terminology, as commonly employed in recording the results of skin tests. We have adopted the plan, therefore, of recording the cytologic findings in terms of plus-minus, 1—, 2—, 3—, and 4-plus eosinophiles and neutrophils. Although many epithelial cells may be noted in specimens, we have attached no definite significance to them. In using this plan of recording the cytology, due consideration must be given to the type of specimen under examination. A scanty amount of secretion may show a small but significant number of eosinophiles, while a good specimen may show a four-plus number. Table IV shows the method of recording the cytologic findings in terms of eosinophiles and neutrophils. Figures 1 to 6 illustrate six representative smears.

The presence of large numbers of eosinophiles in the secretions during quiescent, apparently symptom-free periods, indicates that mild reactions may occur in the mucous membrane without definite symptoms. Patients, therefore, with almost symptom-free seasonal and nonseasonal allergy and with symptom-free asthma may show

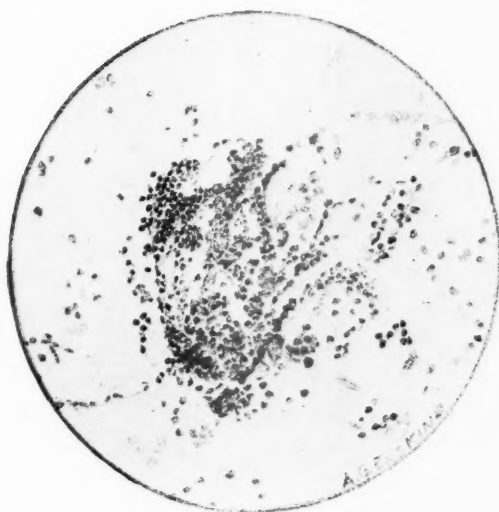


Fig. 2—E++

Clump of eosinophiles with occasional neutrophils, as found in small mass of mucoid secretion.

eosinophiles in the nasal secretions at all times. During quiescent periods, between exacerbations, a large percentage will show no typical changes in the nasal mucous membrane. The membrane may appear quite normal.

In secretion containing both eosinophiles and neutrophils, the latter represent superimposed acute or chronic infection (Fig. 5). In evaluating the numbers of neutrophils in the secretion, one must take into consideration that the neutrophilic response is always greater than the eosinophilic response and that the number of neutrophils usually outnumber the eosinophiles about 10 to 1. A plus-minus or a one-plus number of neutrophils represents about ten times as many eosinophiles. In a smear with four-plus neutrophils, the field is completely covered with them (Fig. 6).

TYPES OF SECRETION AND CELLULAR COLLECTIONS

It has already been pointed out that there is a definite correlation between the cytology of the secretions and the biochemical composition. The gross physical appearance of the secretion may also

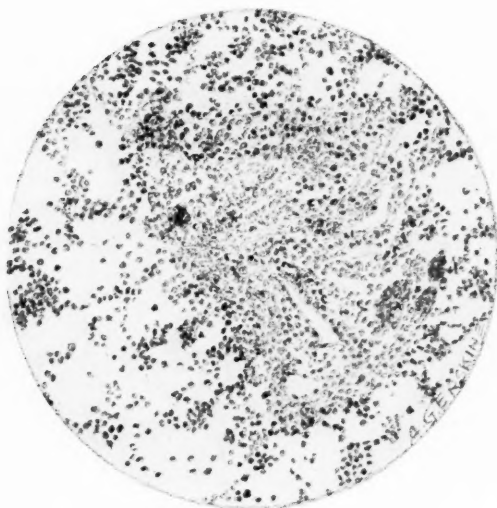


Fig. 3—E++++

Large clump of eosinophiles. Commonly seen in nasal allergy without complicating infection.

be correlated with the cytologic picture. Thin watery or watery mucoid secretion is usually present where the discharge is profuse. Cellular dilution is therefore very high and the microscopic picture may show few if any cells. In the common cold such clear watery secretion will show a few neutrophils. A few scattered eosinophiles in the absence of neutrophils which are usually found in the watery or watery mucoid secretion in nasal allergy are recorded as E+—, or E+ (Table IV and Fig. 1). Larger collections or clumps may also be noted as in Fig. 2, E++. In large clumps of thick mucus or exudate there may be a very dense collection of eosinophiles as seen in Fig. 3, E++++, E++++.

Pure allergic secretion when of the rather thick tenacious type may be infiltrated with eosinophiles throughout, E++++, E++++, but clumping is the rule. This type of secretion may appear yellowish or opaque and grossly it is usually designated by the rhinologist as mucopurulent. This same type of secretion may be noted in infections. It may be densely infiltrated with neutrophils and con-

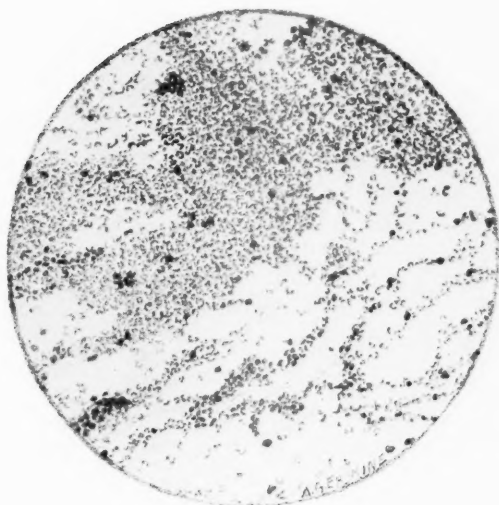


Fig. 4—E+ N+++

Large number of neutrophils with small number of eosinophiles (dark cells), diagnostic of nasal allergy with acute or chronic infection. Compare with Fig. 5.

tain only a few or no eosinophiles, E+— N+++ or N++++, Fig. 6, N++++, N++++.

Watery mucoid secretion may also be streaked with opaque or yellowish masses of mucus. Various numbers of eosinophiles may be found, E+ to E++++. On the other hand, such type of secretion with only infection as in the common cold may contain only neutrophils, N+—, N+, N++. Furthermore, watery mucoid secretion which does not appear yellowish or purulent may appear comparatively clear. If under these conditions, however, the smear is held before a frosted light bulb while still wet it will appear milky. This milky cast is characteristic of secretion of this type with an infectious picture. The milky cast is produced by evenly scattered neutrophils in large numbers, N++++, N++++. In the case of the common cold neutrophils appear in the secretions for about 14 to 21 days.

At the onset or in the end stage of the common cold, various numbers of both eosinophiles and neutrophils may appear in the

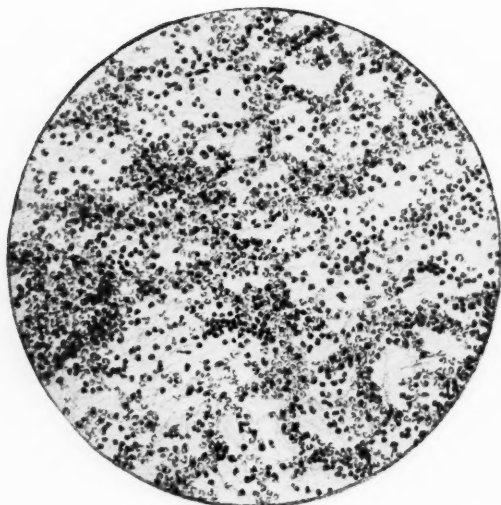


Fig. 5—E+++ N++

Many eosinophiles and neutrophils. This picture observed in nasal allergy (1) in resolution stage of acute infection, (2) with marked nasal obstruction (stagnation), (3) with nasal polyps, or (4) in chronic infection (usually with polyps). Dark cells—eosinophiles; light cells—neutrophils.

secretions, E++, N++, in patients who already have nasal allergy. As a rule the eosinophiles disappear from the picture within one or two days after the onset of a cold, and the neutrophils then appear in large numbers, N++++, N+++++. This purely neutrophilic picture may last for several days to a week. When the resolution stage of the cold begins the eosinophiles reappear. In a nonallergic patient they are scattered and in small numbers with no clumping, E+, N++++, N+++++, Fig. 4. In the allergic patient, however, a larger number of eosinophiles appear at this time. They are scattered in larger numbers than in the normal and often appear in clumps, E+, N++++ or N+++++, Fig. 6. At this stage of a cold in an allergic individual a diagnosis of allergy may therefore be made. As the acute infection further undergoes resolution the number of neutrophils gradually decreases and the eosinophiles increase, Fig. 5, E++, N++++, E++ N++, E+++ N++, E++++ N+, E++++ N+, and finally E+ to E+++++. When

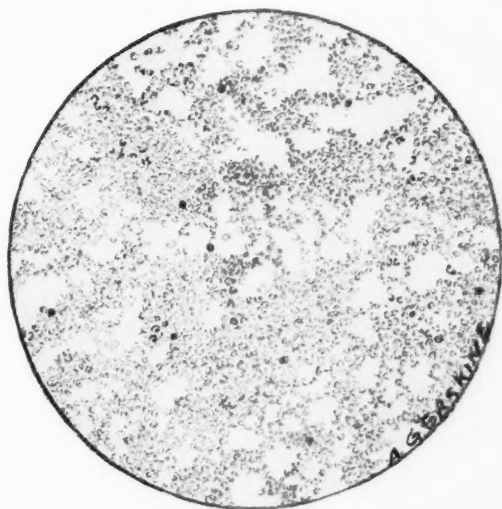


Fig. 6—E+— N++++

Collection of neutrophils with only occasional eosinophiles. This picture characteristic of the common cold in normal individuals or in cases of chronic sinusitis. May be present also in nasal allergy with superimposed acute infection. Eosinophiles not diagnostic of allergy.

the acute infection is prolonged to the subacute stage a high neutrophilia and a low eosinophilia persist. In chronic infections in which a true suppuration is present the neutrophils continue to predominate the picture in large numbers with few if any eosinophiles (Figs. 4 and 6).

The combined eosinophilic-neutrophilic pictures may not only represent the beginning or the end stage of an acute or subacute infection, but may represent various stages of stagnation. The term "stagnation" is employed to signify the retention of secretion in the nose or paranasal sinuses or both as the result of interference with ventilation and drainage of secretion. Such conditions usually exist in patients with marked nasal obstruction from deflection of the septum or from marked obstruction occurring during periods of severe nasal reactions. Similar conditions prevail in the presence of edema, hyperplasia and polyposis. As soon as such interferences with ventilation and drainage are removed the stagnation of secre-

tion is eliminated. With the process of stagnation, certain cytologic pictures are characteristically observed. In such conditions the secretion is usually more thick and tenacious, often opaque or even yellowish in color. It may, however, be comparatively thin and of watery-mucoid type. The stagnation of secretion causes a secondary infection which is usually of the saprophytic type. The cytologic picture is characterized by the presence of various numbers of both eosinophiles and neutrophils. Mild stagnation produces such pictures as E+ N+, E++ N+, E+++ N+, E++++ N+. More severe stagnation, E++ N+++, E+++ N++, E++++ N++ (Fig. 5). With the persistence of stagnation this cytologic picture also persists. It is always a question in these cases upon first examination whether the patient has a cold which is just beginning or which is in the resolution stage. In those instances in which the stagnation is caused by gross pathologic changes such as polyposis the stagnation persists. But in those cases in which the stagnation is caused by simple swelling of the soft tissues of the turbinates the cytologic picture varies. Almost immediately after obstruction in the latter instance is relieved, the stagnation process disappears, the neutrophils become fewer in number, then quickly disappear (24 to 48 hours). Repeated cytologic examinations in these cases will readily demonstrate this phenomenon. If an acute or subacute infection is present the neutrophils will persist throughout the course of the infection and will not disappear in such a manner. The distinction between the stagnation phenomenon and an acute or subacute infection can, as a rule, be made only after repeated cytologic examinations at intervals of one to two or three days.

The stagnation of secretion in the nose and paranasal sinuses in the presence of gross pathological obstructions such as nasal polyps and thickened sinal membranes will persist as long as such conditions exist. The cytologic pictures of stagnation, however, will change if these pathologic changes disappear under allergic therapy and control. With the complete subsidence of these changes the cytologic picture will become eosinophilic or at least predominantly so. In the event that nasal polyps do not disappear with allergic therapy they should be removed. With restoration of nasal ventilation, sinal drainage may also be re-established, thus relieving the stagnation of secretions in the sinuses and changing the cytologic picture. If upon the restoration of nasal ventilation, the cytologic picture of the sinal secretions remains highly neutrophilic, then drainage by means of the antral window or the radical type of operation is indicated. Bacteriologic examinations should be correlated with

the x-ray findings and the cytologic pictures. With the correlation of these findings, therefore, it is evident that the cytology of the secretions represents the most reliable guide in diagnosis as well as in the determination of the clinical course of the disease.

During the winter months, when infections are more prevalent and the nose is subjected to environmental influences, a few neutrophils are found even in normal noses. The presence of certain anatomic changes, such as those which cause obstruction and excessive dryness, may be responsible for the presence of a few neutrophils at any time of the year. Age is often a factor, neutrophils being found more frequently in older patients. The marked obstruction present in the nose during periods of severe reactions causes the retention of secretions and predisposes to their stagnation and secondary infection with resultant neutrophilic response. In cases of seasonal hay fever in which marked obstruction is present, there may be a number of neutrophils present (Fig. 5). In cases with hyperplasia of the membrane, in which a great deal of ciliated epithelium is replaced by the nonciliated types, the secretion tends to remain in the nose for prolonged periods of time and to undergo secondary infection. The greatest degree of stagnation and secondary infection is found in cases of nasal polyps. In most cases of nasal polyps, however, the secretion contains a marked predominance of eosinophils. In these polyp cases the cytology of the secretions is an index of the underlying pathologic process and may be the deciding factor in determining the presence or absence of complicating acute or chronic infection.

The question frequently arises in cases of asthma, in both children and adults, as to whether an exacerbation of symptoms is caused or was caused by an infection or by contact with some allergic substance. This may be readily determined by the examination of the secretion from the nose, and treatment may be regulated accordingly.

Storm van Leeuwen and von Niekerk³⁴ have observed that there is no definite relationship between the percentages of eosinophils in the blood and the clinical symptoms in allergy cases. In the secretions there is likewise no definite relationship to the blood eosinophilia. Marked fluctuations in the blood eosinophilia may occur when those in the secretions are fairly constant in number. These observations have also been made by Cowie and Jimenez.³¹

In cases with atypical symptoms and with no characteristic changes in the nose or in cases with thickening or polypoid changes

in which there is a question of the existence of active allergy, the cytology of the secretions must be relied upon to establish the diagnosis definitely. If acute infection is present with no eosinophiles, the infectious process must be allowed to subside before making a diagnosis. The repeated failure to find eosinophiles usually fits in with the absence of definite evidence of active allergy.

In those patients with seasonal hay fever who continue to have nasal symptoms in greater or less degree after the hay fever season has ended, the cytology of the nasal secretions should be evaluated to determine whether the patient is still having the nasal manifestations of allergy from some other cause. In our experience, more than 80 per cent of the hay fever patients, both children and adults, continue to have the nasal manifestations of allergy in greater or lesser degree after the hay fever season has ended. In some of these cases the symptoms are very marked and in every way similar to those occurring during the hay fever season. In some cases the symptoms are intermittent, simulating the common cold. There are still other patients whose nasal symptoms are atypical. The symptoms may be confined to intermittent nasal obstruction and increased discharge with no sneezing or itching.

Repeated cytologic examinations of the secretions of the nose and paranasal sinuses as a diagnostic procedure and as a means of determining the clinical course as far as complicating infections are concerned are of indispensable value in the study of these cases. The demonstration of eosinophiles in the secretions is good presumptive evidence of the existence of active allergy. The presence of neutrophils in the secretion is an indication of the existence of superimposed infection. The eosinophilic-neutrophilic proportions are an index of the nature and stage of the infection. By repeated observations of the cytology of the secretions, acute and chronic infections can be differentiated.

TYPES OF RESPIRATORY ALLERGY: CLINICAL COURSE ON CYTOLOGIC BASIS

In the group of 341 cases of respiratory allergy listed in Table I, cytologic studies were conducted over a period of eight years. In all, some 3,000 nasal smear examinations were made. The cytologic findings were correlated with other diagnostic procedures. Although only a few examinations were conducted in some cases many patients were repeatedly observed for a period of from six months to five or six years. A few selected cases of various types have been chosen to

illustrate the value of cytologic studies in diagnosis and in determining the clinical course of the respiratory allergy in relation to symptoms, nasal findings, complicating infection, etc.

NASAL ALLERGY (PERENNIAL)

Nasal allergy in the absence of hay fever and asthma is usually not recognized as such because of its similarity to the common cold, or because such symptoms as nasal obstruction and nasal discharge may simulate similar manifestations of enlarged tonsils and adenoids. In the presence of profuse discharge and cloudy x-ray findings in the sinuses, nasal allergy is often designated simply as chronic sinusitis. Nasal allergy must therefore be carefully differentiated from those conditions which may closely simulate it.

Nasal allergy in children not infrequently follows in the wake of infantile colic and eczema, appearing about the age of eighteen months to two years or later. We are often confronted with the diagnostic problem in these cases as to whether nasal symptoms are of allergic origin or the result of other causes. Not infrequently we have observed the development of nasal allergy in eczematous children before our eyes, so to speak. The following case illustrates this point.

CASE 1.—R. B., male, aged 6 years, family history not known. Eczema began at 4 months. No skin tests were performed on account of the severe eczema. There was a clinical sensitivity to egg. He had pneumonia and chickenpox at 8 months. Mild nasal symptoms and occasional sneezing began at the age of 3 years.

OBSERVATIONS	CYTOLOGY		INTERPRETATION
	E	N	
11/ 9/32 Mild nasal symptoms. Cold? Severe eczema.		+	Onset nasal allergy?
12/ 7/32 Mild nasal symptoms.	+		First evidence nasal allergy.
1/18/33 Marked reactions in mornings.	++++	+	Allergic reactions.
3/22/33 Constant and active nasal symptoms.	+		Allergic reactions.
4/26/33 Nasal M. M. pale and boggy.	+	+	Allergic reactions.
8/30/33 Active nasal symptoms.	+		Allergic reactions.
9/27/33 Recent exacerbation. Cold?	+		Allergic reactions.
11/ 1/33 No acute cold. Mild reactions. Secretions thick mucus.	+	++	Mild stagnation.

This child was followed from infancy when he had severe eczema. At the age of 3 years he developed the first symptoms of the nasal manifestations of allergy. Repeated observations through the various seasons showed that the nasal reactions were more or less continuous and of the allergic type with no acute infections.

Nasal allergy should always be suspected in children who have previously had infantile allergy or who have at the time of observation some nonrespiratory manifestation such as urticaria, eczema, gastrointestinal allergy or allergic headache, and who are presented with nasal symptoms which may simulate repeated common colds or bronchitis. The following case illustrates this point. The tonsils and adenoids had been removed for frequent colds and the diagnosis of nasal allergy had not been made. Incidentally he had a cold when he came under our observation, but a diagnostic eosinophilia was present in the nasal secretions in spite of the high neutrophilia.

CASE 2.—C. K., white, male, aged 6 years, entered the clinic on August 30, 1934, because of attacks of urticaria and frequent colds with constant nasal obstruction. The tonsils and adenoids had been removed in September, 1933, with no relief of the respiratory symptoms which had begun about a year previously. Attacks of urticaria had occurred off and on since infancy. During the summer of 1934 the nasal symptoms became more pronounced. X-rays of the sinuses made on September 6, 1934 were negative. When first observed in the allergy clinic on October 13, 1934, he had a cold, the cytologic picture of which is shown in the following table. Two weeks later the cytologic picture was highly eosinophilic. Skin tests showed the following reactions: pea +—, cotton seed +—, tomato +, and horse dander +.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
10/13/34	Mucosa slightly red. Secretions mucoid, yellowish and milky.	+	++++	Acute cold in allergic patient.
10/27/34	Mucosa pale, secretion mucoid, opaque clumps.	++++	+—	Pure allergic reaction.
12/15/34	Earache one week ago. No definite head cold.		+	Recent infection. No active nasal symptoms.
12/29/34	Recent attack of abdominal pain. Nose—mucosa slightly pale, clear secretion.	+	+—	Mild nasal allergy.
2/16/35	Mucosa red. Cold 10 days. Secretion thick, tenacious, yellowish.	+—	++++	Acute infection.

OBSERVATIONS	CYTOLOGY		INTERPRETATION
	E	N	
3/ 9/35 A. M. sneezing. Nasal reactions past week. Secretions mucoid, clear.	+	++	End stage of cold. Return of allergic reactions.
9/28/35 Mucosa pale, mild reactions. Secretion clear.	++	+	Allergic reactions.
10/26/35 Mild reactions. Secretions clear.	+	+	Allergic reactions.
11/23/35 Mild symptoms. Cold 3 weeks ago.		+	End stage of cold.
12/28/35 Mild Symptoms. M. M. pale. Secretions clear.	0	0	Smear not satisfactory.
3/28/36 Cold. Mucopus. Otitis media.		++++	Acute cold with otitis media.
6/20/36 Mild nasal reactions. clear secretions.	++		Allergic reactions.
8/22/36 Nasal symptoms and mild wheezing. Scanty clear secretion.	0	0	Smear unsatisfactory.
11/ 7/36 Cold three weeks ago, lasting only 3 days. Probably allergic reaction. Secretion clear. Mucosa pale.	+		Allergic reactions.
4/ 3/37 Nose clear, recent reactions. Secretion clear.	+		Allergic reactions.
5/15/37 No definite symptoms. Secretions clear, thick.	+—	++	Recent cold or stagnation.

This patient was subject to repeated attacks of urticaria and gastrointestinal upsets since infancy. The respiratory allergy began at the age of 5 years, but the urticaria continued. Before coming under our observation the tonsils and adenoids had been removed to relieve the so-called frequent colds. Some mild wheezing occurred during colds or when the nasal manifestations were marked.

NASAL ALLERGY AND ASTHMA

In older children the onset of nasal allergy may appear only after other manifestations have occurred for several years. The nasal manifestations may continue without asthma. On the other hand, cough may appear in the form of allergic bronchitis. Often this bronchitis is a forerunner of asthma in children. Finally asthma may appear in marked severity following an acute infectious disease, such as whooping cough, measles, scarlet fever, etc. Whooping cough is by far the most common cause of the precipitation of asthma. Measles ranks next in frequency.

In the following patient asthma followed the measles. The nasal symptoms, however, dominated the clinical picture in the more severe form. This patient presented a very persistent and high nasal secretion eosinophilia.

CASE 3.—A. C., female, aged 13 years, positive family history of allergy. Eczema at age of 7 months; measles at 8 years. Other allergy—gastrointestinal disturbances and headache. Onset of asthma followed the measles. Skin reactions—intracutaneous—horse dander +++++, chicken, duck and goose feathers +++, orris +—, wool +, pyrethrum +—, stock house dust +++, cocklebur +, milk +—, wheat +, kapok ++, cottonseed +, chocolate ++.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
6/30/34	Nasal reactions. M. M. pale; mucoid secretions.	++	+	Allergic nasal reactions.
8/18/34	Nasal reactions, hay fever? Skin reactions to ragweed negative. Secretion very thick mucus.	+	++	Allergic reactions. Some stagnation.
9/ 1/34	Clinically no hay fever but nasal reactions continuously.	+++++		Active nasal allergy.
9/22/34	Very thick, somewhat yellowish secretions. Cold?	+++	+	Allergic reactions. No cold.
10/27/34	T. and A. 10/5/34. Nose worse.	+++++		Marked allergic reaction.
11/24/34	Cold? Secretions thick but reactions intermittent.	++	+++	Allergic reactions. Stagnation of secretions.
12/ 1/34	Nasal reactions. M. M. pale. Profuse secretion.	+++++	+	Allergic reactions.
12/ 8/34	Marked reactions. Secretions thick. Infection?	+++++		Allergic reactions. No cold.
12/15/34	Marked nasal obstruction. Secretions thick and yellow.	+++++	+++	Allergic reactions. Marked stagnation.
12/29/34	Acute exacerbations. Thick secretions.	+++++	+	Allergic reactions.
1/ 5/35	M. M. pale, clear mucus.	++	+	Reactions more mild.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
1/12/35	Acute bronchitis and sore throat 3 days. M. M. red. No definite acute rhinitis.	+	+++	Acute infection.
1/19/35	Nose quiescent. Secretion thick.	++++	+	Allergic reactions again following cold.
1/26/35	Mild nasal reactions. Secretion thick.	++	++	Mild reactions. Some stagnation.
2/ 2/35	Mild reactions.	+		Mild reactions. Food restrictions.
2/23/35	M. M. pale, thick secretions. Reactions mild.	++	++	Mild reactions. Stagnation.
3/ 2/35	Nasal reactions in A. M.	++	++	Mild reactions. Stagnation.
3/ 9/35	Profuse secretion, fever, sore throat, asthma, yellow secretion.	++	++++	Onset acute infection.
3/16/35	M. M. pale, thick secretion.	+	++	End stage acute infection.
3/23/35	Nose clear, thick secretion.	++	++	Allergic reactions. Residual cold.

This patient has been closely followed for a period of nine months during the hay fever seasons and during the winter months, and practically all of the nasal exacerbations were of the allergic type. On three occasions acute sore throat and asthma occurred. At times the nasal secretions became very thick and tenacious, especially at the end of acute exacerbations when the nose was quiescent. On these occasions there was an appearance of the stagnation phenomenon with which a moderate neutrophilic response in the cytologic picture was apparent but usually disappeared within a few days. On the whole, the nasal reactions were allergic in nature.

In children with asthma the following problem is constantly presented. Is an exacerbation of symptoms caused by allergic contact or is it caused by an acute infection? Often the history of fever, malaise, purulent nasal discharge and other symptoms is vague, so that diagnosis is frequently dependent entirely upon the cytologic examination of the nasal secretions. A small percentage of children with asthma will have mild or intermittent nasal symptoms. In most instances, however, the nasal symptoms are more or less constant regardless of the frequency of the asthmatic attacks. In the following case the nasal secretion eosinophilia was not constant. The cytologic examination of the secretions showed, however, a high incidence of acute infections.

CASE 4.—T. L., male, aged 6 years. Nasal allergy and asthma. He had nasal symptoms and asthma since the age of 18 months. Family history was negative. He had colic in infancy. Positive scratch tests were found to dog and rabbit hair +, gastrointestinal symptoms from milk.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
1/ 6/32	No nasal symptoms; cough and wheezing two weeks.		+	Poor smear.
1/27/32	Recent asthma.	++	+	Allergic reactions.
2/ 3/32	Mostly cough. Slight wheeze. Secretion clear but thick.	++	++	Onset acute cold?
2/17/32	Asthma marked. Cold?	+-	++++	Acute respiratory infection.
3/ 2/32	Cold clearing. Mild wheeze and cough.		++++	Resolution stage acute infection.
3/30/32	No asthma. Thick secretion in nose.		+++	End stage subacute infection.
8/ 3/32	No symptoms, no asthma 3 months. M. M. pale and boggy. Very scanty secretion.	0	0	Nose quiescent. Poor specimen. Should have some E.
11/30/32	Marked nasal reactions past few days. Secretion clear. Allergy or infection?		++++	Acute upper respiratory infection.
4/12/33	Acute cold and otitis 2 weeks ago. M. M. pale. Secretion clear.		++	Resolution stage acute infection.

During the winter months the attacks were precipitated mostly by infection. The patient gave a negative family history of allergy but had had colic in infancy. The asthma began at the age of 18 months. The cytologic examination of the nasal secretions showed that respiratory infections frequently precipitated asthma and nasal symptoms during the winter months.

HAY FEVER

According to our statistics, hay fever is very common in children with respiratory allergy. Among 341 patients there were 129 or 37.8 per cent with hay fever, as shown in Table V. It is note-

worthy that the pure types of tree and grass hay fever are rare, only four cases of each type having occurred in this series. The remaining 121 patients had ragweed hay fever or a combination of ragweed with the tree and grass types. In our series we feel that the incidence of hay fever is too high, because many cases are not recognized as such, and as a consequence they do not come under our observation. The pure types of hay fever are most frequently overlooked because of the comparatively short period of duration of symptoms. Hay fever is not infrequently designated simply as a summer cold.

In the following case the patient was subjected to tonsillectomy because of colds and was under observation for some time with gastrointestinal symptoms and headache which were not recognized as being allergic in origin. We saw him for the first time with ragweed hay fever.

TABLE V
TYPES OF HAY FEVER
129 Cases (37.8% of 341)

	Hay Fever Only	Perennial Nasal Allergy and Hay Fever	Perennial Nasal Allergy, Asthma and Hay Fever	Total
Tree	—	1	3	4
Grass	—	2	2	4
Ragweed	11	10	33	54
Grass and Ragweed	14	5	15	34
Tree, Grass and Ragweed	4	9	15	28
Tree and Ragweed	—	2	3	5
Total	29	29	71	129

CASE 5.—J. W., white, male, entered the Pediatric Clinic on June 9, 1933, at the age of 5 years for a consideration of tonsillectomy and adenoidectomy because of frequent colds. On June 14, 1933, the tonsils and adenoids were removed. On July 11, 1933, he returned for observation on account of a gastrointestinal upset. The clinical history showed that following the measles three years previously he had been subject to attacks of headache and gastrointestinal symptoms coming on about once a month. Following a head cold and acute bronchitis in December, 1933, an x-ray of the

sinuses was taken on February 13, 1934, which showed marked cloudiness of both antra. Frontals clear. An x-ray of the chest showed an increase of the hilus shadows and lung markings with a clear parenchyma. On March 5, 1934, he returned with a history of cough and vomiting of three weeks' duration, which was diagnosed as pertussis. Following this acute infectious disease he had a persistent cough with mucopurulent sputum lasting three months which suggested a bronchiectasis, but an x-ray of the chest showed no findings in addition to those previously reported. The cough soon disappeared; then the patient developed an enuresis which persisted for several months.

When observed on August 28, 1934, he had had a cough and nasal discharge of two weeks' duration. At this time nasal allergy was suspected, and on September 14, 1934, many eosinophiles were found in the nasal secretion. At this time he also developed an acute eczema of the hands.

We observed this patient for the first time in the allergy clinic on October 6, 1934. Skin tests showed a four-plus reaction to ragweed. The cytologic observations from this time on are recorded in the table below. In May, 1935, he had scarlet fever. An x-ray of the sinuses on September 11, 1935, during the ragweed hay fever season, showed some thickening of the superior margins of the right antrum. On November 11, 1938, he had a severe attack of headache and vomiting which was found to be caused by the ingestion of egg. Skin tests showed reactions to pyrethrum, cocklebur, spinach and chicken in addition to the ragweed.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
10/ 6/34	Sneezing. Nasal discharge clear secretion, moderately thick. Skin test, ragweed +++++.	+	+	End of ragweed hay fever season.
2/ 2/35	La grippe three weeks ago. Nose clear. Moderately thick, slightly opaque mucus.		++	Resolution stage of cold.
2/16/35	No symptoms. Nose clear. Scanty mucoid secretions.		+—	Nose quiescent. No symptoms.
3/ 9/35	Nasal symptoms 4 days. Sneezing and some wheezing. Watery discharge. Cold? Profuse clear, thin mucus.		+	Onset of cold.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
3/16/35	Cold 11 days. Yellowish, milky secretions.		++	Acute cold.
8/ 3/35	Nose clear but some nasal symptoms. Scanty clear secretions.		+—	No symptoms.
8/24/35	M. M. pale. Profuse clear secretion. Sneezing with itching eyes.	+++	+	Ragweed hay fever.
8/31/35	Earache with acute mid ear involvement left side.			No smear.
10/12/35	Nose normal.			No smear.
11/ 2/35	Cold 3 days. Mucosa injected. Secretions mucoid, yellowish, milky. No wheezing.	+—	++++	Acute cold.
4/25/36	Mucosa normal. No symptoms. Scanty secretion.		+	No symptoms.
5/ 2/36	Cold 1 week. Secretion mucoid, milky.	+—	++++	Acute cold.
7/18/36	Mild A. M. sneezing. Secretions clear. Mucosa slightly pale. Grass hay fever?		+	No definite infection or allergy.
4/10/37	No symptoms. Nose clear. Scanty secretions.		+—	No symptoms.
5/15/37	No symptoms. Nose clear. Scanty secretions.		+	No symptoms.
7/17/37	No symptoms. Nose clear. Scanty secretions.		+—	No symptoms.
7/24/37	Mild A. M. sneezing. Grass hay fever? Scanty, clear secretion.	0	0	No definite infection or allergy. Grass hay fever.
9/25/37	End of ragweed season. Mucosa pale. Secretions moderately thick but clear.	+++	++	End of hay fever season. Some stagnation.
11/ 6/37	Mucosa red. Cold 1 week. Secretions clear. mucoid.		++	Mild acute cold.
12/18/37	Mucosa red. Secretions clear and watery. Cold, onset 5 weeks ago.		+	Recovery from recent cold.
1/ 8/38	No symptoms. Mucosa normal. Scanty normal secretions.	Mucus only.		No symptoms.
8/26/39	Ragweed hay fever. Mucosa pale. Profuse clear secretions, with small opaque clumps.	++++		Ragweed hay fever.

This case emphasizes the importance of recognizing such manifestations as gastrointestinal allergy, allergic headache and skin allergy in a patient with ragweed hay fever. Although non-respiratory allergy may be present with or without nasal symptoms and asthma, the presence of the latter should be considered as good presumptive evidence of the allergic nature of the other complaints. A study of the cytology of the secretions reveals the purely seasonal (ragweed) nature of the respiratory allergy. Non-seasonal respiratory symptoms were found to be due to other causes.

The following case is interesting in that the onset of hay fever was detected during the course of a long standing eczema. The incidence of acute infections throughout the clinical course of symptoms was readily determined on the basis of the cytologic examinations.

CASE 6.—W. B., male, aged 8 years, ragweed hay fever and mild asthma. Family history, negative. He had colic in infancy. He had eczema of the face before the onset of nasal symptoms. There was a pale, boggy nasal mucous membrane. Skin tests—scratch—corn + + + +, egg +, pyrethrum +—, ragweed ++. Skin tests, June 13, 1936—poplar +, maple ++, timothy +, ragweed + + + +, marsh elder +, cocklebur + + + +, orris +, silk +, egg + + + +, and cabbage +.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
8/ 3/32	Eczema. No nasal symptoms, except recent cold. No hay fever.		++	Eczema. Recent cold.
2/ 1/33	Mild eczema, la grippe one month ago.	+—	+++	Evidence of recent infection.
3/15/33	Nasal stuffiness. Mild reactions.	+—	++	Mild cold.
4/12/33	Recent nasal reactions. M. M. pale, thick secretions.	++++	+++	Allergic reactions. Secondary infection.
5/10/33	No nasal symptoms until few days ago. Allergic exacerbation? M. M. pale.		++++	Acute infection.
6/21/33	No more eczema. Mild nasal symptoms.	+		Mild allergic reactions.
8/26/33	Symptoms of hay fever two weeks, for first time.	+		Hay fever.

OBSERVATIONS		E	CYTOLOGY		N	INTERPRETATION
1/24/34	Nasal M. M. pale; cold or allergy?			+++		Acute infection.
2/ 7/34	No nasal symptoms.				+	Nose quiescent.
3/ 7/34	M. M. pale, mucoid secretion, allergy?	+—		++++		Acute infection.
4/18/34	M. M. pale, thick secretion. Stuffy nose.				++	Mild infection.
6/18/34	T & A.					
8/18/34	Mild hay fever.	+				Hay fever.
8/ 8/34	Mild hay fever. Less than 1933.	+				Hay fever.
10/13/34	Mild nasal reactions.				+	No active allergy.
11/24/34	M. M. pale, allergic reactions? Thick mucus.	+—		++++		Acute infection.
12/ 8/34	No nasal symptoms.				+	Nose quiescent.
2/ 9/35	Sneezing, recent dust contact, allergic reactions or cold? Secretion mucoid.	+—		++++		Acute infection.
3/23/35	M. M. pale, clear, thick mucus.	+—		+++		Subacute infection.
5/ 4/35	Profuse secretion, not much sneezing. M. M. pale.				++	Onset of cold?
3/ 7/36	No definite nasal symptoms, clear secretion.				+	Nose quiescent.
3/14/36	Cold 1 week. Secretion mucoid, yellow streaks.				++	Acute cold.
3/21/36	Cold two weeks. Secretions mucoid, milky.				+++	Acute cold.
6/13/36	Sneezing 1 week. Secretions clear. Mucosa pale.	+				Grass hay fever. Probably timothy or corn.
8/22/36	Hay fever symptoms. Profuse, clear secretions.	+				Ragweed hay fever. High cell dilution.
3/ 6/37	Mucosa pale. Secretions clear, mucoid.	+				Tree hay fever.
6/12/37	Mild nasal reactions. Secretions mucoid, opaque streaks.	+++			+—	Grass hay fever
9/ 4/37	Ragweed hay fever. Marked pallor. Clear, profuse secretion.	++				Ragweed hay fever.
1/ 8/38	Mucosa slightly pale. Secretions mucoid, yellowish streaks.				+	Nose quiescent.
3/26/38	Sneezing, mucosa pale. Thin watery, mucoid secretions.	+				Tree hay fever.

This patient was first observed as a case of eczema with no nasal manifestations of allergy, but with occasional acute colds. When he recovered from his eczema in the spring of 1933, he developed nasal symptoms of allergy with periodic reactions. Note that in April 1933 he showed a large number of eosinophiles in the nasal secretions for the first time. He continued to show an eosinophilia during the grass and ragweed hay fever seasons. The skin tests showed reactions only to ragweed, but clinically there was evidence of tree and grass hay fever, as shown by the cytology of the nasal secretions. There was no evidence of active nasal allergy outside of the pollen seasons. The nonseasonal nasal reactions were caused by acute infections, as shown by the cytologic picture. Positive evidence of tree, grass and ragweed hay fever was confirmed by positive skin reactions to trees and grasses in June 1936.

HAY FEVER AND ASTHMA

Asthma is not infrequently a complication of hay fever. More than fifty per cent of our patients had asthma with the hay fever. Some hay fever patients have asthma only with the hay fever, and occasionally a patient who has only seasonal hay fever and asthma may have attacks of asthma outside the hay fever from colds. In the following case it is interesting that colds would or would not produce asthma during the fall and winter months.

CASE 7.—D. C., female, aged 12, positive family history of allergy. She had eczema in infancy. She had had asthma and hay fever since the age of 5 years. Her tonsils and adenoids were removed at the age of 6 with no change in symptoms. Skin reactions—scratch—wheat, goose feathers, pyrethrum, orchard grass and poplar +—, redtop ++, sweet vernal +, ragweed +++++, string bean +, and cat hair ++.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
4/28/34	Nasal M. M. pale. Recent reactions.		+++	Recent cold.
5/ 5/34	M. M. pale, no symptoms.		+—	Cold subsided.
5/19/34	Mild reactions, cold?		+—	Onset of grass hay fever? Poor smear.
5/26/34	Sneezing, grass hay fever?		+	Onset of grass hay fever? Poor smear.

OBSERVATIONS	CYTOLOGY		INTERPRETATION
	E	N	
6/ 9/34 Mild asthma, sneezing, M. M. pale.	+		Definite grass hay fever.
6/30/34 Nasal reactions, profuse, watery mucus.	++		Grass hay fever.
9/ 1/34 Nasal reactions mild. Ragweed.	+		Ragweed hay fever.
11/ 3/34 Recent asthma and nasal reactions. M. M. somewhat pale.	+-	++++	Acute infection.
11/24/34 Mild nasal symptoms. Secretions thick mucus.		++	End stage of cold.
12/22/34 Cold 3 days. Secretions clear, profuse, watery.		++	Onset of cold.
1/26/35 Recent asthma with nasal reactions.		++	Resolution stage of cold. Allergic contact also?
3/ 2/35 Mild nasal reactions. Nose stuffy.		+-	No definite reactions.
3/16/35 Cold 3 days. M. M. pale. Secretion clear.		+	Onset of cold.
3/23/35 M. M. pale, cold 10 days.	+-	++++	Acute cold.
3/30/35 Secretion very thick. No definite symptoms.		++	Final stage of cold.
4/ 6/35 Cold two weeks. Secretion mucopurulent.	+-	+++	Acute cold.
5/25/35 Mild asthma. Cold? Secretion clear.		+	Onset grass hay fever.
6/ 9/35 Marked reactions 2 days. Mucosa pale. Secretion thick, mucoid.	+	++	Grass hay fever. Stagnation.
6/22/35 Mucosa pale and boggy. Sneezing. Secretion clear.		+	Continuation of hay fever.
7/ 6/35 Nasal reactions marked. Secretion watery.	0	0	No cells on account of high dilution.
8/17/35 Onset of ragweed hay fever season. Secretion clear and mucoid.	++		Ragweed hay fever.
5/16/36 Mucosa pale, but no symptoms. Secretion clear and very scanty. Time of onset of grass season.	0	0	Insufficient secretion.

This patient has had nasal reactions at all seasons of the year but the allergic reactions have been confined to the grass and ragweed hay fever seasons. The nonseasonal reactions were intermittent and occasionally accompanied by asthma. The cytology of the secretions proved the infectious nature of the nonseasonal nasal reactions. It is apparent that the nonseasonal asthma was of an infectious nature, but it did not always occur with the colds. This suggests that perhaps some allergic contact was also necessary with the colds to produce the asthma.

PERENNIAL NASAL ALLERGY AND HAY FEVER

It has already been pointed out that more than half the patients in the group of hay fever cases also had both perennial nasal allergy and asthma. In these patients the most striking eosinophilia often occurs during the hay fever seasons. In some instances a diagnosis of hay fever in the absence of positive skin reactions could be made on the basis of the severity of the symptoms and the marked nasal secretion eosinophilia. The following case illustrates several important points; first, the patient was originally observed during a cold with an infectious cytologic picture. The eosinophilia appeared, however, with the subsidence of the cold. Second, there was a very high secretion eosinophilia during the hay fever seasons, and finally, the exact incidence of colds during a period of four years could be accurately determined on a cytologic basis.

CASE 8.—F. R., male, aged 12. Onset of nasal symptoms and cough resembling acute colds six years previously following pertussis. The tonsils and adenoids were removed in January 1934, with no relief of symptoms. In 1935 he began to have symptoms of hay fever. Our observations began on January 4, 1936. At the first visit he had an acute cold with large numbers of neutrophils and no eosinophiles in the nasal secretions. The eosinophilia, however, appeared on January 18, 1936. Skin tests showed the following positive reactions: poplar +, oak ++, cocklebur +++, marsh elder ++, ragweed ++, grasses negative.

OBSERVATIONS	CYTOLOGY		INTERPRETATION
	E	N	
1/ 4/36 Cold 2 weeks. Secretions mucopurulent. Mucosa infected.		+++	Acute cold.
1/11/36 Mucosa slightly pale. Secretions mucoid, yellowish streaks.		++	Resolution stage of cold.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
1/18/36	Sneezing and profuse discharge, moderate obstruction, secretions mucoid.	+	+	Allergic reactions.
1/25/36	Secretions mucoid, Moderate symptoms. Mucosa pale.	+	+	Allergic reactions.
2/ 1/36	Sneezing, mucosa pale. Secretions clear, watery, mucoid.	+		Allergic reactions.
2/ 8/36	Marked nasal reactions. Marked pallor. Profuse, watery mucoid secretions.	+++	+	Marked allergic reactions.
3/ 7/36	Nasal vestibules excoriated, cold? Secretions profuse, clear.	++	+	Dermatitis of vestibules from profuse discharge.
3/21/36	Mucosa pale. Profuse secretions, mucoid, rather thick.	+	++	Stagnation.
4/11/36	Mucosa pale. Secretions clear, mucoid.	+	+	Allergic reactions.
5/ 2/36	Mild nasal reactions. Secretions mucoid, slightly thickened.	+	++	Allergic reactions.
5/16/36	Mild nasal reactions. Secretions mucoid, slightly thickened.	+	+++	Allergic reactions.
4/10/37	Recent cold. Secretions mucopurulent.		+++	Acute cold.
4/17/37	Thick, mucoid, secretions.		++	End stage cold.
6/26/37	Great deal of sneezing. Mucosa pale. Secretions clear, profuse, thin, mucoid.	++++		Grass hay fever.
7/ 3/37	Marked nasal reactions. Mucosa boggy, moderate obstruction, secretion moderately thick, mucoid.	++	++	Grass hay fever. Stagnation.
9/ 4/37	Ragweed hay fever. Mucosa pale, profuse, watery, mucoid secretions.	+++		Ragweed hay fever.
3/26/38	Cold two weeks. Sneezing great deal. Secretions mucopurulent. Tree hay fever season.	+—	++++	Acute cold.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
6/25/38	Mucosa pale and boggy. Secretions moderately thick with opaque clumps.	++++		Grass hay fever.
7/ 9/38	Clear mucoid secretion with opaque clumps.	+++		Grass hay fever.
7/16/38	Mucosa pale. Secretions mucoid, moderately thick.	+	+	Grass hay fever.
8/13/38	Ragweed hay fever. Clear, thin secretions.	+		Ragweed hay fever
8/20/38	Ragweed hay fever. Clear, thin secretions.	++		Ragweed hay fever
9/24/38	Mucosa very edematous. Secretions profuse, mucoid.	++++		Ragweed hay fever
10/ 8/38	Secretions moderately thick mucus. Mucosa pale.	+	++	Hay fever season terminated. Mild stagnation.
10/29/38	Cold? Sneezing 2 weeks. Secretions mucoid, streaked. Pale mucosa.	++	+	Allergic reactions with some stagnation.
11/ 5/38	Mucosa pale. Clear, watery secretions.	+		Allergic reactions.
11/12/38	Mucosa pale. Clear, watery secretions.	++		Allergic reactions.
12/ 3/38	Mucosa pale, Clear, watery secretions.	+		Allergic reactions.
2/ 4/39	Mucosa pale. Secretion clear, slightly thick.	+	+	Allergic reactions. Mild stagnation.
4/15/39	Mucosa pale, scanty secretions.		+—	Nose quiescent.
5/20/39	Pale mucosa. Secretions watery, mucoid. Recent cold.	+	++	Grass hay fever. Allergic reactions. Stagnation.
7/29/39	Secretions profuse, opaque clumps.	++++		Grass hay fever.
8/26/39	Very pale mucosa. Watery mucoid secretions.	++		Ragweed hay fever.
9/ 2/39	Pale mucosa, cough. Cold? Secretions clear, mucoid.	++++	+	Ragweed hay fever.
12/16/39	Mucosa pale. Secretions watery, scanty. Beginning polyposis left side.		+—	Nose quiescent.

This patient developed nasal symptoms and cough for the first time following pertussis at the age of 6 years. The tonsils and adenoids were removed without relief. When first observed in the allergy clinic he had an acute cold. The cytologic picture of allergy was first noted two weeks later. During the tree hay fever season, on March 26, 1938, note that he had an acute cold. It is often a question whether such an exacerbation of symptoms is caused by the allergic process or an acute infection. It is noteworthy that a very high eosinophilia and an increase in severity of symptoms occurred during the grass hay fever season but the skin reactions to grasses were negative. Clinically, grass hay fever was present. During the four-year period of observation there were only four acute colds. With the approach of this patient to the age of puberty it is noteworthy that a nasal polyposis is developing.

The following case illustrates the occurrence of gastrointestinal allergy in a patient with nasal allergy, hay fever and asthma. The occurrence of the stagnation phenomenon from marked nasal obstruction can be distinguished from the attacks of acute infectious colds.

CASE 9.—M. B., male, aged 12 years, nasal allergy, mild asthma, grass and ragweed hay fever, positive family history of allergy. Accompanying manifestations: erythema multiforme, gastrointestinal allergy. He had had symptoms since the age of three years. He had a pale, boggy mucous membrane. An x-ray showed both antrums completely opaque. Skin reactions—scratch—horse dander, goat hair, chicken feathers, dog hair +, wool, pyrethrum, orris, milk and potato +—, ragweed +, June grass +, oak +++++, willow +—, blue grass +++++, timothy +.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
1/13/32	Nasal reactions, mild asthma. Thick mucous secretions.	+	++	Allergic reactions. Stagnation.
3/ 2/32	Nasal reactions. Mild wheeze first in two months. Pale M. M.	+		Allergic reactions.
3/23/32	Cold 10 days, allergic reaction? Asthma 5 days ago. Thick mucus.	+	+++	Acute infection.
4/13/32	Nose dry, but having nasal reactions.	+++	+	Allergic reactions.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
5/18/32	Marked nasal stuffiness, thick secretion, no asthma.	+	++	Allergic reactions. Stagnation.
6/22/32	Nose dry, thick mucus, mild reactions, no asthma.	+		Mild allergy.
7/ 6/32	Sneezing and mild wheeze, dry nose, thick secretion.	++++		Allergic reactions. Grass and timothy.
8/24/32	No asthma for two weeks. Mild nasal symptoms. M.M. pale. Hay fever?	+++	+	Allergic reactions. Mild stagnation.
6/ 9/34	Recent asthma. Nasal M. M. pale.	++++	+-	Allergic reactions.
7/21/34	Asthma two weeks ago, nose and secretions clear.	+++		Allergic reactions.
8/25/34	Mild asthma, nasal M. M. pale.	++++		Allergic reactions.
9/22/34	Nose clear, secretion clear, mild asthma.	+++		Allergic reactions.
3/30/35	Nose fine. Small amount of secretion.	+	+	Almost symptom-free.
4/27/35	Abdominal pain, nausea and vomiting. Mild nasal symptoms. Scanty secretion.		+-	Attack of G-I allergy. No definite nasal symptoms.
5/25/35	Mild reactions. Secretion clear and scanty.	0	0	Cell dilution. None found.
8/31/35	Reactions moderate for two weeks. Secretion clear and mucoid.	++		Ragweed hay fever.

The patient had more or less continuous nasal symptoms with periodic attacks of asthma. Colds were not frequent. There was tendency to thick secretion, with some stagnation. He had grass and ragweed hay fever, with large numbers of eosinophiles in the nasal secretions at this time of the year.

The following patient is one of two brothers (Case 2) who came under observation at a time when each had an acute cold. The cytologic picture of the nasal secretion was diagnostic of allergy with a cold. The following patient had hay fever and asthma in addition

to perennial nasal symptoms. Both these children had had a tonsillectomy for relief of colds before coming to the clinic.

CASE 10.—G. K., white, male, aged 8 years (brother to patient in Case 2). He had had nasal symptoms of sneezing, obstruction and discharge for about three years. Tonsils and adenoids were removed in September 1933, with no relief of symptoms. Cough and occasional wheezing were associated with marked nasal symptoms, especially with hay fever. On September 6, 1934, an x-ray of the sinuses showed almost complete opacity of the right antrum and slight haziness of the left. Frontals clear. Skin tests showed the following reactions: oak +, June grass +, ragweed +++, pyrethrum +, cocklebur +++, rice +—, oat +—, horse dander +—, rabbit hair +—.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
10/13/34	Recent acute cold. Mucosa red. Secretion thick, yellowish.	+	++++	Cold in an allergic patient.
10/27/34	Moderate nasal reactions. Mucosa pale, secretions clear with opaque streaks.	++++	+	Allergic reactions.
1/12/35	Nose clear. Scanty secretions.		+—	Nose quiescent.
2/16/35	Cold 10 days. M. M. red. Secretions thick, yellowish.	+	++++	Cold superimposed on allergic process.
3/ 9/36	Mild sore throat. No definite nasal symptoms.		+	No nasal symptoms. Sore throat.
4/ 6/35	M. M. pale. Secretions mucoid and rather thick, opaque.	++++	+	Marked reactions. Mild stagnation.
8/31/35	Marked symptoms 2 weeks. Ragweed hay fever. M. M. pale, very boggy. Secretions clear.	+	+	Ragweed hay fever. Mild stagnation.
9/28/35	M. M. pale. Secretion thick, mucus. End of hay fever season.	++	+	End of ragweed hay fever season.
10/16/35	Marked nasal symptoms. Mucosa pale. Secretions clear.	++++		Marked allergic reactions.

	OBSERVATIONS	CYTOLOGY		INTERPRETATION
		E	N	
11/23/35	Cold several days. Secretions milky, mucoid. M. M. slightly red.	+—	++++	Acute cold.
12/28/35	Mild symptoms. Secretions watery, mucosa pale.	0	0	No cells. High dilution.
3/28/36	Tree hay fever? Cold? Secretions thick, mucoid.		+++	Acute cold.
6/ 6/36	Marked nasal symptoms. M. M. pale. Secretion clear mucus.	++++	+	Grass hay fever.
6/20/36	Mucosa pale. Edematous polypoid tissue left. Secretions clear.	++		Acute edematous polyposis. Grass hay fever.
8/22/36	Moderate ragweed hay fever symptoms. M. M. pale. Secretions clear, profuse.	+		Ragweed hay fever. Very profuse secretion. Cell dilution.
11/ 7/36	Mild symptoms. M. M. pale. Secretions clear.	+		Mild nasal allergy.
4/ 3/37	Mild symptoms. Edema of left middle meatus. Secretions thick.		++	Recent cold. Persistence of edema of left side of nose.
5/15/37	Rather marked symptoms. M. M. boggy. Secretions clear mucus.	0	0	Secretion clear. No cells. Onset of grass hay fever.
10/ 9/37	M. M. pale and boggy, but secretions thick and milky.		++++	Acute cold.
11 /6/37	M. M. pale. Profuse mucoid secretion. Cold?	+	+	Allergic reactions.
11/13/37	M. M. pale, sneezing. Secretions clear.	+		Allergic reactions.
3/19/38	M. M. pale. Secretions thick, yellowish streaks. Cold?	++	+++	Cold or stagnation.
7/ 9/38	Moderate symptoms. Grass hay fever.	++	+	Grass hay fever.
7/16/38	M. M. pale. Secretions clear mucus.	+		Grass hay fever.
8/13/38	Ragweed hay fever. Secretions thin, clear.	+		Ragweed hay fever.

The patient presents the symptoms of a perennial nasal allergy as in the case of his brother, Case 2, but in addition has tree, grass and ragweed hay fever. During a period of four years, six colds occurred but always during the fall and winter seasons. Note that the nasal secretion eosinophilia varies according to the character of the secretion—few eosinophiles when watery; large numbers when thick or containing mucoid clumps.

NONRESPIRATORY ALLERGY, COLDS, BRONCHITIS AND SINUSITIS

In the analysis of the entire series of 455 cases observed in this study it is noteworthy that 114, or 25 per cent, did not prove to have respiratory allergy (Table I). Forty-four patients already had other manifestations of allergy, and seventy patients had no allergic manifestations but were suspected of having respiratory allergy.

In the group of patients who already had nonrespiratory allergy a significant percentage was found to have nasal allergy, hay fever or asthma. An attempt was made to observe these patients over a sufficiently long period of time with repeated cytologic observations to determine definitely the presence or absence of respiratory allergy. Among the younger children we were able to detect the onset of nasal symptoms or asthma for the first time. The negative cases were returned for otolaryngologic observation with the first appearance of symptoms suggesting the onset of respiratory allergy. In the group of patients with colds, bronchitis and sinusitis, cytologic observations were carried out for several months to a year or more. In all these patients the common cold commonly appears and may temporarily obscure the cytologic picture of allergy if the patient should have respiratory allergy. The plan was followed, therefore, of making observations during periods when the patient was free of an acute cold or when the nasal symptoms were quiescent. If an eosinophilia of the nasal secretions was present it could be detected at this time. On the other hand, the persistence of a high neutrophilia in the secretions over a long period of time was an indication of chronic infection. Cloudy sinuses upon x-ray examination should be consistent with these findings. These principles of diagnosis also apply to the patient with respiratory allergy who has developed a subacute or chronic infection of the sinuses.

It is apparent, therefore, that the diagnosis of chronic sinus infection, as a rule, cannot be established until an acute process can be ruled out and until sufficient time has elapsed and repeated cytologic examinations have been made to establish the diagnosis of chronic infection.

In the diagnosis of bronchitis and asthma, cytologic observations on the nasal and bronchial secretions are of indispensable value in differentiating asthma from other conditions such as chronic infectious bronchitis, bronchiectasis, tumors and foreign bodies of the trachea and bronchi. Jackson's dictum that "all that wheezes is not asthma" must be taken into consideration in the diagnosis of all unusual cases. In these cases an erroneous diagnosis of asthma is not infrequently made. It is apparent, therefore, that cytologic studies of nasal and bronchial secretions should be a routine procedure of the bronchoscopist.

The following case report is representative of this group of patients who were investigated for the presence of respiratory allergy. Although this patient had a large number of colds, the infectious processes were of the acute type. Observations made during quiescent periods showed a normal-appearing nose with only a few neutrophils in the secretions. It was definitely proved, therefore, that the patient did not have respiratory allergy and that he did not have a chronic sinus infection. The positive x-ray findings were probably present during an acute cold. Antrum puncture, however, proved to be negative.

CASE 11.—P. E., male, aged 8, positive family history of allergy. The onset of colds and questionable wheezing was after whooping cough. He had occasional gastrointestinal upsets, and occasional headaches. T. and A. one year ago had no effect on his colds. On February 17, 1934, the adenoids were removed a second time and the antrums were washed and found to be clear. X-rays had shown the antrums cloudy two weeks previously. Result of cold? Skin reactions—scratch—dog, cat, pyrethrum, egg, salmon, marsh elder and ragweed +—.

OBSERVATIONS	CYTOLOGY		INTERPRETATION
	E	N	
4/18/34 Bronchitis and ? asthma.		++++	Acute infection.
5/26/34 Cold and sore throat. Enlarged cervical glands.		++++	Acute infection.
6/ 2/34 Nasal reactions, M. M. somewhat pale. Secretions thick mucus.	+—	++++	Active stage of cold.
6/16/34 Some nasal stuffiness and thick.	+—	++	Subacute infection.

OBSERVATIONS	CYTOLOGY		INTERPRETATION
	E	N	
9/ 8/34 Nasal reactions four days, profuse watery mucoid secretion, M. M. pale.	+—	++++	Acute infection.
10/27/34 Cold one week.	+—	++++	Acute infection.
11/24/34 No cold, nose clear, no symptoms.		+—	No symptoms. Nose normal.
12/24/34 Cold 10 days, M. M. good color, secretions clear mucus.	+—	++++	Acute cold.
2/ 2/35 No nasal symptoms.		+—	Nose normal.
3/16/35 M. M. rather red, thick mucus. Recent cold?	+—	+++	Recent cold.

This child gave a positive family history of allergy and other manifestations such as gastrointestinal upsets and headache which possibly might have been of allergic origin. He had bronchitis and some questionable wheezing, but this could not be proved to be asthma. At no time did the cytology of the nasal secretions indicate that the nasal reactions were of an allergic nature. In this type of case long-continued observations during periods of reactions and during periods of quiescence must be made before it can definitely be determined whether an active allergy is present. Treatment on the basis of prophylaxis regarding the colds and the institution of proper nutritional measures must be carefully followed in these cases.

CONCLUSIONS

In the diagnosis and treatment of the common diseases of the nose and paranasal sinuses and the tracheobronchial tree, the cytologic examination of the secretions should occupy the key position as a diagnostic procedure. Cytologic determinations should be correlated with the symptoms, physical findings, x-ray examination, histopathologic examination and the bacteriologic findings.

Cytologic determinations are therefore of indispensable value in:

1. Establishing the diagnosis of nasal allergy and asthma.
2. Determining the presence of acute, subacute or chronic complicating infection in allergy.
3. Detecting the presence of stagnation or secretions.

4. The diagnosis of hay fever—seasonal eosinophilia of the secretions.

5. The diagnosis of acute, subacute and chronic sinusitis.

6. The differentiation of allergic bronchitis and asthma from other conditions which may simulate it.

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A STUDY OF MORTALITY RECORDS OVER
A TEN-YEAR PERIOD*

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Strictly speaking, each death represents a clinical failure. Some of these, of course, are inevitable. The ravages of time and of disease may make any other outcome quite impossible. On the other hand, there must be many deaths which might have been avoidable, with earlier attention or different therapy. To review one's deaths, in retrospect, frankly and honestly, should develop a certain amount of valuable information. An audit of the professional work of the staff in hospitals has been recently advocated, and very likely will become an accepted hospital procedure in the near future. This calls for the classifying of cases according to type, as elective, emergency or palliative, to risk, and to results obtained, with notations as to errors of diagnosis, judgment, treatment or technique. This general form will be followed in so far as possible in this report.

My thought is to review my own mortalities, for a given period, without regard to their disease classification. One must beg forbearance with the frequent use of the first person singular, obviously made necessary by the nature of this report. I am arbitrarily taking the past ten years for this study. My reason for this is that, for this period, practically all of my work has been done in one hospital, making for accessibility and uniformity of records. However, I shall include such patients upon whom I may have operated in other hospitals during this period. While we may feel necessarily handicapped under such circumstances, when not in constant charge of the case, this makes little or no difference to the patient or the undertaker. The latter, particularly, is not influenced by alibis. As nearly as it is possible to ascertain, patients who have died after leaving the hospital from the same condition for which they were under treatment will be included also.

Sex: Sixty-two per cent of these cases were males, 38 per cent, females.

*From the Thayer Hospital, Waterville, Maine.

Age: The ages varied from a new-born infant to 83 years. Ten per cent were infants of one year or under. The following table shows the percentages according to decades.

1 Decade	22%
2 Decades	8%
3 Decades	6%
4 Decades	4%
5 Decades	12%
6 Decades	18%
7 Decades	22%
8 Decades	6%
9 Decades	2%

The cases comprising this study are grouped as follows: Malignancies, 42 per cent; laryngo-tracheo-bronchial conditions, 24 per cent; intracranial complications, 18 per cent; neck infections, 10 per cent; oral and nasal cavity infections, 6 per cent; miscellaneous, 2 per cent. Thirty-three per cent of the malignancy cases were esophageal. Nineteen per cent occurred in the paranasal sinuses. The causes of the laryngo-tracheo-bronchial conditions, in order of frequency, were: acute fulminating laryngo-tracheo-bronchitis, vegetal bronchitis and subsequent lung abscess, aspiration of chemicals, bronchiectasis, tuberculosis, congenital malformation and obstetrical trauma. Fifty-five per cent of the intracranial deaths were due to meningitis; 33 per cent to brain abscess.

If these figures can be taken as a sort of yardstick, a review of the malignancy group suggests that in the average otolaryngological practice about 40 per cent of the deaths will be due to cancer, and that one-third of these will be esophageal and one-fifth in the sinuses. In cancer of the sinuses, pharynx, tonsil or nasopharynx, surgery, radiation, or a combination of both may effect a cure of the primary lesion, but secondary metastasis may subsequently prove fatal. This has occurred a number of times in this series. One case first showed an epidermoid carcinoma, Grade III, on the posterior wall of the hypopharynx. This disappeared under roentgentherapy but six months later a histologically similar lesion appeared on the left tonsil. This completely disappeared after treatment with radon implants. Three months later he developed a carcinoma in the thoracic esophagus. The element of delay in seeking treatment is a big factor in all cancer cases. Laryngeal cancer is usually amenable to surgical treatment, but circulatory complications may be factors in the post-

operative period. In one of our cases, death was due to embolism twelve days after laryngofissure.

As might be expected, acute fulminating laryngo-tracheo-bronchitis is the greatest cause of death in the endoscopic cases. Here, too, the element of delay in obtaining proper treatment is the greatest factor, although many of these cases seem to defy even quite ideal therapy. While it is usually seen in infants, one case in this series, due to staphylococcus albus, was in a 21-year-old woman. Here there had been a delay of one week before sending her to the hospital. Vegetal bronchitis may result in lung abscess and drowned lung. Aspiration of chemicals may produce severe damage to the respiratory mucosa, causing inevitable fatalities.

The figures for the intracranial deaths are probably of least value today, as advances in chemotherapy, through the use of sulphanilamide, are greatly reducing meningeal fatalities. Only two of the deaths in this group received sulphanilamide, and this when the drug was first introduced. Both cases were unconscious and had well-advanced meningitis before treatment was started. One case, secondary to fracture of the skull through the ethmoids and cribriform plate, had had his nose tightly packed by his family physician for 24 hours before admission. In another case, with a fracture through the ethmoid and orbit, and extending into the petrous portion of the temporal bone, the possibility of intracranial involvement did not receive the consideration it should have, until two months later when vomiting, fever and stupor suggested the obvious to the attending physician. When referred for operation, the drainage of a large frontal lobe abscess was unavailing, and death shortly ensued. While the deaths in this group should be considerably reduced in the future with our improved therapy, the inability of many physicians to recognize the signs of mastoiditis, or to appreciate the possibilities of intracranial complications will still be a contributing factor. Most of the cases of meningitis and brain abscess in this series were in extremis when admitted.

Deep infections of the neck often present most serious problems. Delay in instituting adequate drainage is, perhaps, the chief cause of death in most instances. This delay may be due to late reference of the case for operation or to an ill-advised attempt to avoid external incision. One case in this series, seen and operated upon when practically moribund, had been on sulphanilamide therapy for six days with sublime confidence in this drug. Other factors may be the type and virulence of the infecting organism, and the condition of

the patient. A man, aged 55, developed a Ludwig's angina seven weeks after removal of the parotid gland for carcinoma. Apparently the infection entered through the partially unhealed incision. There was marked subcutaneous emphysema extending to the clavicle. Drainage was instituted and a tracheotomy performed. Post-mortem examination revealed a mediastinitis with many gas bubbles. Culture showed a growth of a facultative hemolytic streptococcus. The technical problem of adequate drainage may present difficulties at times, which are only brought to light by the postmortem examination.

Occasionally infections of the nasal and oral cavities with some of the fungi or higher forms of bacteria present discouraging and hopeless problems of treatment. A case of *Sporothrix* infection, and another of *Actinomyces*, gradually went on to fatal termination despite literally months of treatment with every therapeutic agent we could think of. It may be difficult or impossible to isolate the real causative agent, or blood dyscrasias may be important factors. In one long-drawn out case with final sloughing away of the entire roof of the mouth and subsequent involvement of the cavernous sinus, the only organism obtained was the *staphylococcus aureus*.

Type: The classification of cases as to type on admission is shown in the following table:

Elective	8%
Emergency	46%
Palliative	26%
Diagnosis Only	20%

The "diagnosis only" cases were endoscopic cases sent in for diagnosis, where biopsy revealed malignant disease in the bronchi or esophagus, and subsequent treatment, by radiation, was in other hands. We have kept track of these cases as far as possible and include the known deaths in this table. We will exclude these from the following tables, however, as the obviously poor prognosis would make our percentages appear falsely favorable.

Risk: The classification as to risk on admission is shown in the following table:

Good	5%
Fair	12.5%
Poor	82.5%

Cases were classified as "poor risks" when their condition or diagnosis on admission justified this. This group included the malignancies, the severe laryngo-tracheo-bronchial cases, brain abscesses and meningitis, when admitted as such, certain of the neck and mouth infections, and cases in which severe cardiac conditions added to the gravity of the situation. The risk was considered fair in certain of the neck infections, in carcinoma of the larynx, and in cases in which any cardiac condition was considered to be well compensated.

POSTMORTEM EXAMINATIONS

Autopsies were performed upon 22.5 per cent of these cases. This is increased to 34.6 per cent when only the deaths occurring in the hospitals are considered. In addition, postmortem endoscopic examinations were done upon a number of endoscopic cases in infants when permission for autopsy could not be obtained. If these findings are to be considered of value, and they at least confirmed the diagnosis, the ratio of postmortem examinations to cases dying in the hospital would be increased to 57.6 per cent.

Ratio of P.M. to total deaths	22.5%
Ratio of P.M. to deaths in hospital	34.6%
Ratio of P.M. and P.M. endo. exam. to deaths in hospital	57.6%

Results: The following table shows the analysis of the final results:

Inevitable	37.5%
Justifiable	20 %
Justifiable at stage of admission to hospital	30 %
Not justifiable	12.5%

Deaths were listed as "inevitable" when due to conditions which are quite universally fatal and for which our present-day therapy is ineffective. Deaths were considered as "justifiable" when due to conditions not necessarily fatal but when the particular circumstances made this result unavoidable. Deaths listed as "justifiable at the stage of admission to the hospital" were those which were apparently hopeless at that time but which might have recovered with earlier attention or different pre-admission treatment. Deaths which would seem to have been avoidable and for which errors of diagnosis, judgment, treatment or technique might be attributed were listed as "not justifiable." Similar errors may likewise be found

in the other groups, although they apparently had little or no effect on the final outcome.

Inevitable Deaths: In this group are included cases of inoperable cancer, severe bronchial involvement due to aspiration of lye and of acid, congenital atresia of the esophagus, rupture of the trachea of the new-born at delivery, hemangioma invading the skull, hemangioblastoma complicated by decompensated heart condition, and bronchiectasis with severe myocarditis. One of the carcinoma cases had the lesion superimposed upon an esophageal stricture. In one case of carcinoma of the larynx, the heart condition was at least a contributing factor to death.

CASE 20.—Man, aged 61. Carcinoma of larynx, chronic myocarditis with decompensation. In hospital four months under medical treatment in an endeavor to get in condition for operation. Lesion apparently was confined to the left half of the larynx. Seen in consultation by one of our prominent laryngologists who advised laryngofissure. Preliminary tracheotomy performed. At operation it was found that the lesion had involved the thyroid cartilage. Cutting current used for excision. Two days later patient had a sudden profuse hemorrhage and died in six minutes. Postmortem examination revealed "generalized arteriosclerosis, left ventricle hypertrophy, atelectasis of right middle lobe of lung, cirrhosis of liver and metastatic glands in anterior mediastinum."

Process was too extensive, and general condition unsuitable, for surgical treatment. Roentgen therapy or radon implants would have been preferable. Error of judgment.

The following death is listed as "inevitable" because of the condition found on postmortem examination, but a study of the record discloses definite errors of diagnosis and of judgment.

CASE 13.—Man, aged 65. Patient first admitted because of intractable cough. After what was considered thorough study, including a diagnostic bronchoscopy, the condition was attributed to chronic sinusitis and a radical operation upon the antra and ethmoids performed. Two months after discharge he was readmitted with a diagnosis of pneumonia, from which he apparently recovered. Six weeks later he was readmitted, unconscious and with a temperature of 103 degrees. Had had severe headache for two weeks. Spinal fluid appeared normal but gave a 4-plus Wassermann reaction. X-ray

of chest was characteristic of a miliary tuberculosis. Died in ten days. Postmortem examination revealed an edematous brain with a cortical hemorrhage in the temporosphenoidal lobe. Histopathology of lung tissue consistent with either lues or tuberculosis.

Errors of diagnosis and judgment on earlier admission. Attention was focused on sinuses without sufficient consideration of other factors. Sometimes presenting clinical signs masks underlying conditions of greater importance. There is no point in operating upon physical wrecks.

Justifiable Deaths: In this group are included certain cases of malignancy, brain abscess, acute fulminating laryngo-tracheo-bronchitis, and infections of the neck and of the oral cavity. Delay in seeking treatment was a factor in all of the cancer cases but this is so universal with all malignancies that it hardly warrants any other classification than "justifiable" for these deaths. Deep infection of the neck due to anaerobic streptococci, and involvement of the nasal and oral cavities by *Sporothrix* or *Actinomyces* were considered in this group, as was a death due to embolism 12 days after laryngofissure.

Death Justifiable at the Stage of Admission: In this group are included cases of meningitis, brain abscess, deep infections of the neck, vegetal bronchitis, and acute laryngo-tracheo-bronchitis. Delay was the main factor in all of these cases and often was due to an error of judgment on the part of the family physician. In each of these cases a careful study of the history suggests the probability of a different outcome with earlier attention.

Nonjustifiable Deaths: As stated before, these are deaths which should not have occurred and which might be attributed to errors or to procedures in the hospital, which subsequent study has shown to have been incorrect.

CASE 16.—Man, aged 23. Infection of the pharyngomaxillary fossa, secondary to peritonsillar abscess. Intra-oral incision on admission, no pus found. The following day external incision through the submaxillary fossa was done and apparently adequate drainage instituted. Laryngeal edema developed, necessitating tracheotomy. Death ensued suddenly the following day. Postmortem examination revealed an undrained pocket of pus, laterally to tonsil and high, near the base of the skull. While this was an emergency case it was

classified as a "fair risk." Result undoubtedly due to inadequate drainage. Error of technique.

CASE 21.—Man, aged 61. Infection of the neck, secondary to deep abscess of the tongue, of three days duration. Intra-oral incision on admission. External drainage through the submaxillary approach instituted the following day. Improved but then became violently delirious on the third day, requiring restraint. Died of circulatory failure, due to toxemia, on the fifth day. Postmortem examination could not be obtained.

This was an emergency case but it was considered a fair risk. While the condition was complicated by toxic delirium, we must consider the delay of one day in instituting external drainage a factor. Error of judgment.

CASE 24.—Girl, aged 15. Meningitis, secondary to lateral sinus thrombosis. Consultation case seen in another hospital. Mastoiditis of four weeks duration. Had had one chill. Temperature, 105 degrees. W.B.C., 10,750; polymorphonuclear leucocytes, 69 per cent. Perisinus abscess found at operation. Following this the temperature came down to normal. Blood cultures were persistently negative. W.B.C. always low. Middle ear became dry following operation. Twenty-three days later patient had a chill, followed by a temperature of 104 degrees. Seen again in consultation. Tobey-Ayer test positive. Internal jugular vein ligated and sinus opened. Thrombus found in region of bulb. Died eight days later of meningitis. Postmortem not obtained.

The risk in this case should have been good, and the result was not justifiable. Both operations should have been performed earlier. More careful observation after the finding of a perisinus abscess should have indicated opening of the lateral sinus before the onset of fulminating sepsis. Error of judgment.

CASE 42.—Girl, aged 9. Meningitis, secondary to infection of the petrous apex. There had been an unrecognized otitis media of five weeks' duration. Developed severe frontal headache and sixth nerve paralysis on the same side as the otitis media. She had been drowsy and vomiting some for one week prior to being referred by the family physician. Serosanguinous discharge followed incision of the membrana tympani. At time of admission to hospital there was no headache and she felt perfectly well. The middle ear resolved

but sixth nerve palsy persisted. Daily temperature elevation of about one degree. Roentgenogram showed a slightly cloudy mastoid, apparently resolving, and what appeared to be a small area of necrosis at the petrous apex. On the fifth day there was a sudden onset of severe headache and projectile vomiting. Spinal fluid was cloudy and showed streptococci on smear. Operation revealed a resolving mastoiditis and granulations on the dura in the zygomatic region. Drain introduced to petrous apex along superior border. Repeated lumbar punctures done, and prontosil given intravenously. Patient was unconscious and having repeated convulsions. Died 48 hours later. Permission for postmortem examination limited to mastoid region. Granulations were found in the peritubal cells, leading into an abscess cavity on the posterior-inferior aspect of the petrous apex.

The first error in this case was one of diagnosis on the part of the attending physician, prior to admission. After admission I hesitated about accepting what now seems the obvious diagnosis of petrositis, during a period of latency. More reliance on the history and the roentgenogram should have suggested immediate operation. With the onset of meningitis the opportune time had been lost. Errors of judgment and treatment.

CASE 18.—Woman, aged 68. Diaphragmatic hernia, acute esophagitis, acute cardiac failure. Patient referred by attending physician for esophagoscopy, with a provisional diagnosis of carcinoma of the esophagus. X-rays, taken in another hospital, were reported as showing a probable malignancy of the lower esophagus. There was a history of ill health for a long time, difficulty in swallowing and regurgitation of food. Esophagoscopy, rendered difficult by a cervical exostosis, revealed gastric mucosa seventeen inches from incisor teeth. Following this the patient reacted poorly and seemed prostrated, but there was no evidence of mediastinitis. Completely afebrile course. Died of cardiac failure seven days later. Post-mortem examination could not be obtained but endoscopic examination revealed no injury of the esophageal wall.

This patient was a poor risk because of a definite myocarditis and esophagoscopy should not have been done, merely on the request of the referring physician. Good roentgenograms, properly interpreted, would have obviated this. It is sometimes a tragic mistake to assume conditions on data from outside sources and puts one in the class of a mere technician, and perhaps a poor one at that. Competent medical study in this case would have indicated the inadvisability of any such procedure. Error of judgment.

If, for the sake of argument, these mortality statistics might be assumed to represent those of the average otolaryngological practice, then certain thoughts suggest themselves. We might assume that 35 to 40 per cent of our deaths are inevitable and that about 20 per cent more are justifiable. Probably with our present degree of knowledge and skill we can expect no decrease in this group of deaths. In other words, 55 to 60 per cent of our mortalities are due to things beyond our control. Perhaps this may become somewhat modified in time as people come to realize the importance of early attention to possible precancerous conditions. Another 30 per cent, representing deaths justifiable at time of admission to the hospital, should be susceptible to improvement, if the factor of delay in diagnosis could be overcome. This should depend largely upon earlier recognition of significant signs and symptoms by the attending physician, usually the family doctor. Perhaps the answer to this lies in the continued development of a comprehensive program of graduate education for the medical profession. Of course a certain decrease in this group should be affected by the recent advances in the treatment of meningitis, as most of these cases were included in this group.

We should expect the greatest improvement in the 12.5 per cent representing nonjustifiable deaths, provided we can learn from experience.

The important things, as I see them, brought out by study of these cases are:

1. The danger of procrastination or temporizing in the face of serious conditions, such as deep neck infections or infections of the petrous apex.
2. The danger in assuming conditions from data from possibly unreliable sources.
3. The necessity of knowing that a patient is in proper condition to withstand even the simple procedures.

SUMMARY

The deaths occurring in a ten-year period are reviewed. They are classified as to causes, type, risk and result. Forty-two per cent of these were due to malignancies; 24 per cent to laryngo-tracheo-bronchial conditions; and 18 per cent to intracranial complications. Postmortem examinations were performed upon 34.6 per cent of the

deaths occurring in the hospital. This is increased to 57.6 per cent if postmortem endoscopic examinations are included. Thirty-seven per cent of the deaths were considered inevitable; 20 per cent justifiable; 30 per cent justifiable at time of admission to the hospital; and 12.5 per cent nonjustifiable. Any improvement in mortality statistics must be looked for in the last two groups. In the third group, where delay in recognition of significant signs and symptoms was an almost universal factor, improvement may come as a result of the further development of a continuation program of graduate education for the profession.

The lessons brought out by study of the cases in the group of nonjustifiable deaths should prevent recurrence of at least similar mistakes in the future. To generalize, these indicate the importance of a good history, properly interpreted; of a thorough examination, based upon data known to be reliable; of careful observation; and of the danger of procrastination, or temporizing in the face of serious conditions.

PROFESSIONAL BUILDING.

XLVII

THE USE OF HUMAN CONVALESCENT SCARLET FEVER SERUM IN STREPTOCOCCIC INFECTIONS INVOLVING THE EAR, NOSE AND THROAT*

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LOS ANGELES

Another disease which has heretofore claimed its annual toll of human lives is rapidly losing ground before the onslaught of scientific progress: namely, hemolytic streptococcic infections treated by pooled human convalescent scarlet fever serum with or without combined sulfanilamide therapy.

Pooled convalescent scarlet fever serum had been in use for that specific disease for some time with rapid and often dramatic results. Then in 1931, in response to an increasing demand from physicians for some serum with which to combat violent streptococcic infections, the Samuel Deutsch Convalescent Serum Center in Chicago suggested that this same scarlet fever serum be employed. They had been impressed by the fact that the clinical picture of fulminating streptococcic infections and certain types of septic or complicated scarlet fever displayed no sharp line of differentiation. The doctors first employing the serum, on private patients, did so independent of outside pressure or influence with an attitude of impartiality and often, perhaps, with their tongues in their cheeks.

Thalhimer and Levinson report that in 11 per cent of these cases there was an almost immediate critical termination of the infection with marked decrease in temperature and prostration and cessation of the disease process. Forty-four per cent showed a good effect with slower but nevertheless definite and progressive improvement leading to complete recovery. In 17 per cent although the patient eventually recovered, the results were considered doubtful, since there was not sufficient indication as to what role the serum played.

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There was no demonstrable improvement and no effect reported in 28 per cent of this particular series. However, the mortality rate for this entire group, consisting of 122 patients suffering from severe diverse streptococcic infections, many of them fulminating and with a grave prognosis, was only 19 per cent.

One of the principal advantages of using the human serum is that it produces no foreign protein reactions or sensitization as has been the experience with animal sera. While the best effects are obtained with large doses of the convalescent serum, administered either intravenously or intramuscularly, it is not necessary to resort to blood matching. This is of particular value because the blood used is taken from several convalescing patients and pooled to obtain the immune substances of the various streptococci. After going through a rigid process of testing and preparation, the serum not being distributed for immediate use may be dried and stored.

This article is based on reports obtained from doctors using the human convalescent scarlet fever serum from the Serum Center at the Childrens Hospital in Los Angeles, established there by Dr. Clarence M. Hyland in 1935. It is limited to those having a streptococcic infection of the ear, nose or throat. In this particular series there are 37 cases, many of them private patients. They are not necessarily complications of scarlet fever or scarletina, although a few such instances are included.

In this series is a group of 16 cases having otitis media and mastoiditis of which nine required mastoidectomies. Remarkable, almost dramatic, results were noted in four cases receiving the convalescent scarlet fever serum. There was an immediate drop in temperature and lessening of the toxic symptoms with rapid, uneventful recovery. In seven the convalescence was slower but definitely good and far better than might have been expected had the serum not been administered. In only four were the results debatable, as no demonstrable changes could be attributed to the serum.

Only one patient in this first group died. He was admitted with a temperature of 104 degrees in a state of marked dehydration which did not respond to the usual treatment. On the fourth hospital day he developed an acute edema of the right leg and right groin. There were suspicions of a thrombosis of the femoral vessel as well as a lateral sinus thrombosis. His temperature continued to rise in spite of an injection of scarlet fever serum which in this instance seemed to have no effect whatsoever. Autopsy revealed death to be due to an acute streptococcic septicemia.

In this particular group of the series, eight received sulfanilamide in addition to the serum. Whether or not sulfanilamide was given seems to have made very little, if any, difference in the course of the disease and the patient's recovery. However, in the presence of a grave illness, neither one should be denied when indicated.

There were five cases of streptococcic meningitis in the series. These were secondary to mastoiditis; surgical intervention had been performed on all five. Two of these improved dramatically and immediately after receiving the serum; one had already been receiving considerable sulfanilamide without much effect. Convalescence was uneventful and the results excellent. A third patient showed some immediate improvement but developed a large abscess in the left buttock at the site of the scarlet fever serum injection, which in this instance was given intramuscularly. Her progress was retarded until this abscess had been opened and drained. Although her subsequent convalescence was uneventful, she developed a left internal strabismus while in the hospital, which was still present at the time of her dismissal.

In this same group two patients received sulfanilamide in addition to the serum. One made an uneventful recovery. The other, a boy, improved slowly and gradually, but four days after being discharged from the hospital he was seen in the Outpatient Department, at which time a diagnosis of scarlet fever was made. In this case as well as in the fifth patient, who expired, the value of the serum may be considered questionable. However, in the latter instance, the patient had undergone a mastoidectomy on the left side with ligation of the jugular vein. Immediately after surgery he received 40.0 cc. of scarlet fever serum and his temperature dropped to normal where it remained for four days. On the fourth day it rose suddenly to 105 degrees. The mastoid wound was reopened and no pathology found. Two subsequent injections of the convalescent scarlet fever serum of 20.0 cc. and 40.0 cc. respectively failed to elicit any response and the patient expired. In the entire series of 37 cases, however, there were only the two deaths already mentioned.

There were four cases of laryngotracheobronchitis and three of streptococcic pharyngitis; tracheotomies were performed on three of these. In this particular group it is interesting to note that the rate of recovery and the definite signs of improvement were much slower and more gradual in three of the patients who were treated with prontosil or prontosil in addition to the scarlet fever serum. In the others who received only the serum, except one on whom a trache-

otomy had been performed, improvement was immediate and almost spectacular. This may have been merely a coincidence; nevertheless, I feel that it is an interesting phenomenon.

The most dramatic improvements following injection of the scarlet fever serum occurred in five cases of streptococcic sore throat. Only one of these also received sulfanilamide which did not seem to affect the progress of the infection either one way or the other. This response to the serum definitely places streptococcic sore throat among the curable diseases whereas formerly it was a serious illness often with grave results.

The series includes one report of retropharyngeal abscess with complicating cervical adenitis, toxic anemia, Ludwig's angina, and an otitis media. In spite of serum injections this patient's progress was very slow until after the abscess had been opened and drained. Thereafter the convalescence was rapid and uneventful. This is another example that early treatment cannot be overly emphasized.

One instance of beginning peritonsillar abscess responded well to the scarlet fever serum and the patient improved without surgical intervention. On the other hand, its value in a case of cervical adenitis is questionable. The patient also received sulfanilamide, and though her convalescence was uneventful, it was decidedly slow.

Reaction to the serum was observed in only one instance. This patient had a previous long history of allergy to various things and entered the hospital with asthma, cervical adenitis, and pneumonia complicating scarlet fever. She developed an urticaria after receiving 40.0 cc. of the scarlet fever serum, and no more was given. She also received adequate doses of sulfanilamide and subsequently recovered.

Out of this group of 37 patients, four typical interesting cases are worth giving in detail.

CASE 1.—R. D., a male, aged 15, entered the hospital on April 29, 1939. The onset of his illness had begun five days previous to admission with chilly sensations and sore throat followed by a rash over the body. The past history and family history were essentially negative. On physical examination he appeared to be well nourished but quite ill. His pulse was 120 and regular, respirations were 28 a minute and his temperature 103.2 degrees. Other positive findings included enlargement and tenderness of the cervical nodes and marked injection and swelling of the pharyngeal wall and both ton-

sillar regions. A membrane coated the tonsils. The heart revealed only a roughening of the first sound over the mitral area; a macular-type rash covered the entire trunk, neck, and extremities.

The urinalysis was negative but the blood report showed a marked leucocytosis of 23,300. Culture of the throat showed streptococci only.

Following admission the patient was given symptomatic therapy plus sulfanilamide grains 15 every four hours. Despite this treatment his condition grew steadily worse; the pulse continued to be rapid, there was precordial heaving, and the patient had difficulty in breathing and swallowing. On the following morning 80.0 cc of convalescent scarlet fever serum were given intravenously. Within twenty-four hours the patient's temperature dropped from 104 to 100 degrees and his pulse from 150 per minute to 100 per minute. Sulfanilamide was discontinued on the following morning. His recovery from then on was uneventful.

CASE 2.—W. M., white, male, aged 11, was admitted to the Childrens Hospital on September 6, 1938, with a history of a chronic discharging ear. The discharge had a foul odor. A radical mastoidectomy, right, was performed on September 18th, at which time an extensive cholesteatoma was encountered and the lateral sinus was exposed. A congenital sixth nerve palsy was noticed before the operation and immediately afterward he developed a bilateral orbital edema and right zygomatic swelling.

On the first postoperative day the packing was removed because of swelling and disorientation; profuse bleeding was encountered and the cavity was repacked. The temperature at that time varied between 100.0 and 101.0 degrees. The following day he was disoriented and confused and on the third postoperative day experienced a marked chill, after which his temperature rose to 106.2 degrees. Repeated blood cultures taken at that time showed hemolytic streptococci of the alpha type. The next day a second chill was experienced, at which time the temperature was 105.4 degrees. The patient had been receiving prontosil and methylene blue 45 grains per day since the operative date. Following the second chill and rise in temperature, he was given 100.0 cc. of scarlet fever convalescent serum. No further chills or sudden rise in temperature were experienced. Subsequent blood cultures were sterile and the symptoms and temperature gradually regressed.

CASE 3.—J. R., white, male, aged 39, had his right ear drum lanced on April 1, 1939. He was admitted to the hospital on the following night with profuse drainage and intense ear ache. His temperature on admission was 100 degrees, the white count was 14,500, and a culture from the ear showed a streptococcus hemolyticus. The patient was treated with subcutaneous injections of sulfanilamide, which he received for five days. The temperature remained normal after the third day, although profuse drainage and mastoid tenderness continued.

X-rays revealed haziness and destruction throughout the right mastoid. A mastoidectomy was performed on April 13th; the dura and lateral sinus were exposed and appeared normal.

On the second postoperative day the patient complained of right diplopia. Horizontal nystagmus was present, being more marked when he looked to the right. The leucocytosis at that time was 21,400. The spinal fluid was clear, contained one cell, and pressure was 100 mm.

The postoperative course was stormy with projectile vomiting and vertigo. On April 21st he was given 100.0 cc. of convalescent scarlet fever serum intravenously with definite signs of improvement. An additional 100.0 cc. were given April 23rd and his convalescence was uneventful.

CASE 4.—T. C., white, female, aged 32, was admitted to the hospital on September 25, 1939, with a diagnosis of left mastoiditis and meningitis. She gave a history of having had a left otitis media two months previous to admission with spontaneous rupture of the drum five days after the onset. The ear drained for about six weeks. Five days before being admitted to the hospital, the patient complained of double vision and increasing left-sided headache. She experienced no fever or chills.

X-rays were taken on admission and revealed cloudiness of the left mastoid with destruction of the cells. An emergency mastoidectomy was performed that same day.

The patient's postoperative course was stormy. She was nauseated, vomited, complained of double vision and a stiff neck. On September 28th a spinal tap revealed 5,500 cells, pressure 175 mm., and a culture of streptococcus viridans. Vomiting continued and the patient received a transfusion of 500.0 cc. whole blood. She was also put on subcutaneous injections of sulfanilamide, 600.0 cc. every four hours. These were discontinued on October 6th.

This patient's condition remained unchanged until September 30th, on which day she was given 200.0 cc. of convalescent scarlet fever serum. The improvement was immediate. The pain lessened and vomiting stopped. The temperature dropped from 101 and 102 degrees to normal, where it remained from October 3rd to the time of discharge on the 23rd.

Spinal taps were performed during the course of the illness with the following interesting changes: on September 30th there were 3024 cells, on October 2nd, 470 cells, on October 4th, 130, and on October 13th from 10 to 20 cells.

CONCLUSIONS

1. There seems to be definite proof in the foregoing that patients suffering with hemolytic streptococcic infections are benefited by the use of pooled convalescent scarlet fever serum. This is especially true in cases of streptococcic sore throat and laryngotracheobronchitis. In the latter instance it is possible that given in sufficient quantity and early enough, it will do away entirely with the necessity and hazard of tracheotomies.

2. Dramatic results have been obtained with the use of human convalescent scarlet fever serum in streptococcic meningitis, one of the most dreaded complications of mastoiditis.

3. It is not absolutely essential to prescribe sulfanilamide in conjunction with the serum; in fact, in some instances the serum alone seems to obtain quicker results. Nevertheless, as long as they do not counteract each other, both should be used when indicated.

4. Too much emphasis cannot be placed on the early use of convalescent scarlet fever serum in adequate doses for streptococcic infections, especially since the hazards of using this serum are non-existent and such reaction as may occur is easily controlled.

1930 WILSHIRE BLVD.

Appreciation is expressed to those doctors using the convalescent scarlet fever serum from the Serum Center at the Children's Hospital who gave their permission for such cases to be included in this report.

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XLVIII

PATHOLOGY OF THE SUBEPITHELIAL (REINKE'S) LAYER OF THE VOCAL CORDS*

RICHARD WALDAPFEL, M.D.

GRAND JUNCTION

The loose tissue of the larynx has been the subject of thorough investigations even in the relatively early periods of laryngology. The purpose of these investigations was to study anatomically and experimentally the spreading of liquids injected into the submucous tissue of the larynx and to compare the results with the conditions occurring in edema and inflammatory infiltrations of the living. The most important research in this subject comes from Hajek¹ (1891). It showed extensive analogy between experimental and clinical findings and brought definite results for all parts of the larynx, with the exception of the vocal cords.

Before going into further details a brief survey of the normal anatomical structure of the vocal cords will be given.

In a frontal cross section of a normal vocal cord,** which has been stained with elastica stain (Fig. 1), the main mass is formed by the cross cut muscular fibers of the internal thyroarytenoid muscle (M). There, where this mass towards the free edge of the vocal cord (V) becomes somewhat wedge-shaped, a texture of elastic fibers (E) is interwoven with these muscle fibers without any tissue in between. Between this elastic layer and the epithelium (Ep) there exists a minimal layer of tissue, hardly visible (R) which ends as well on the superior as inferior surface approximately two millimeters from the free edge of the cord. Where this loose tissue ends mucous glands (G) appear which are lacking in the edge of the vocal cord, and the epithelium changes from squamous to cylindrical epithelium.

*Presented before the Colorado Otolaryngological Society, Children's Hospital, Denver, Colorado, April 6, 1940.

**All of the following low power microphotographs of the cords (Figs. 1, 2, 3, 8, 9, 10) have been taken with the same lens to permit comparison of the size of the layers of the cord. Each picture represents one vision field in the microscope, seen with the same low power lens.

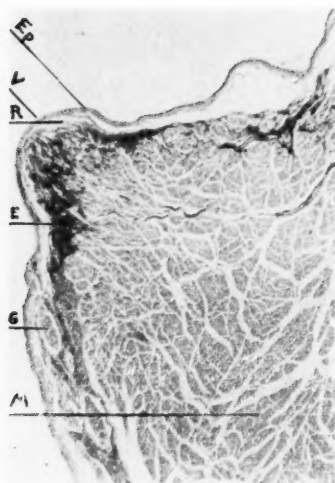


Fig. 1.

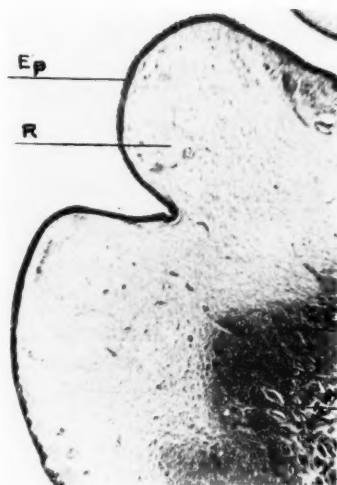


Fig. 2.

Fig. 1. Frontal section of a normal vocal cord. Elastica stain. *Ep*—epithelium; *V*—free edge of the vocal cord; *R*—subepithelial (Reinke's) layer; *E*—elastic layer; *G*—glands; *M*—muscle.

Fig. 2. Subepithelial edema in a case of carcinoma of the ventricular band. Frontal section of the vocal cord. Hematox. eosin stain. *Ep*—epithelium; *R*—subepithelial layer, enormously extended, edematous (compare with normal-sized subepithelial layer in *R* in Fig. 1); *E*—elastic layer; *M*—muscle.

This subepithelial space has been neglected by former examiners, and Hajek as well did not pay any particular attention to it, because he made his injections deep into the body of the cord.

The knowledge of the existence and of the qualities of this space we owe to Reinke,³ who confirmed Hajek's results in 1895 and completed them in so far as he showed that it is possible in exact fine injections with thinnest needles to get under the epithelium of the edge of the cord and to produce, even here, a considerable accumulation of liquid or air. The spreading possibilities of this layer end sharply at a superior and inferior limiting line which corresponds approximately to the appearance of the glands and beyond which the injection can hardly extend even with the application of force. Hajek has given credit to the first describer of this space and has

named it after him. Under this name it was recorded as "Reinke's Space" in the anatomical and laryngological nomenclature.

What part does this subepithelial layer play in pathological conditions of the vocal cords?

I have studied a series of diseased larynges with quite different affections in this respect, and shall discuss the findings which contribute to the answer of this question.

Figure 2 is taken from a patient who had a carcinoma of the right ventricular band and whose larynx had been removed by total extirpation. It is a frontal cross-section through the right vocal cord and shows an impressive picture: Between the epithelium and elastic layer of the cord there is a broad space to be seen which is filled with loose tissue in the meshes of which, on some places, serous fluid is discernible. Farther laterally the elastic layer of the vocal cords (E) and the beginning of the musculature (M) is visible; farther medially the epithelium (Ep). This broad edematous space, therefore, is nothing but the subepithelial "Reinke's Space," in Fig. 1 hardly visible and here in Fig. 2 enormously extended to a multiple of its normal width. Further evidence is the fact that this tissue does not contain any muscle fibers or aggregations of elastic fibers, but only constituents of the subepithelial layer. The enormous dilatation of this space can be judged best by comparison of Fig. 1 and Fig. 2, which are both photographed with the same lens power; in Fig. 1 this space is minimal and a great part of the muscle is visible, while in Fig. 2 this space fills the greatest part of the vision field and has displaced the muscle fibers far outwards.

Therefore, we are concerned here with a high grade subepithelial edema of the free edge of the vocal cord distinctly situated in Reinke's layer and dilating this layer considerably. A similar case has been depicted and described by Hajek.²

There occurs, therefore, also in the living, under pathological conditions, an edematous imbibition and expansion of the subepithelial layer which corresponds to the experimental infiltration of this layer as accomplished by Reinke.

The edema itself may well be explained by stagnation caused by the adjacent tumor and pressure on lymph vessels and veins.

In a case of trichinosis I have found an almost identical picture in a quite different disease of the vocal cord.

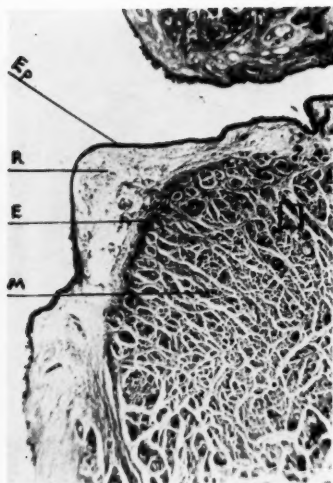


Fig. 3.

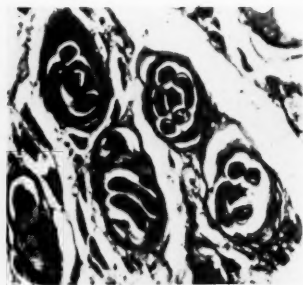


Fig. 3a.

Fig. 3. Subepithelial edema in a case of trichinosis. Frontal section of the vocal cord. Hematox. eosin stain. *Ep*—epithelium; *R*—subepithelial layer, considerably dilated, edematous (similar to *R* in Fig. 2); *E*—elastic layer; *M*—muscle containing innumerable trichinae.

Fig. 3a. Enlargement of area marked with square in Fig. 3. Encapsulated trichinae in the muscle fibres.

Figure 3 shows a frontal cross-section of a vocal cord in this case taken from an autopsy specimen. One can see between the epithelium and muscle fibers a broad space (*R*) which corresponds to the subepithelial layer *R* of Fig. 1, but is dilated many times its normal size similar to Fig. 2. Structure and microscopical details also resemble the preceding case. Again muscle fibers and aggregation of elastic fibers are definitely lacking in this area.

It deals, without doubt, again with an extensive edema of Reinke's layer, this time caused by a trichinous disease of the muscle of the vocal cord. Here, too, stagnation must be regarded as the cause of the edema. And it is distinctly to be seen that this subepithelial layer more readily permits edematous swellings than the connective tissue between the muscle fibers, which doesn't appear considerably dilated though the pathology is situated in the muscle itself.

Also, this picture of the living corresponds completely to the picture in Reinke's experiment.

Such subepithelial edema may occur even in much less serious diseases of the vocal cords than carcinoma and trichinosis. A clinical case under my observation may be cited as further example:

E. H., 57 years old, waiter, had been hoarse for years. He has to do much talking and breathing in smoke-filled quarters. While he has formerly had acute spells of hoarseness which subsided more or less, he has been chronically hoarse for the last few years and has never regained his normal voice. He has no other complaints whatsoever, either in breathing or in swallowing.

The voice is fairly low and jerky. The laryngoscopy shows the picture represented in Fig. 4. The larynx is dirty-gray and shows symptoms of a chronic laryngitis. Both vocal cords are thickened considerably in the anterior two-thirds, but the swelling is no hard infiltration but rather soft and flabby, quivering in movements of the cords, which gives us cause to think of fluid accumulating under the epithelium of the vocal cords. The effect of the treatment is further evidence for the correctness of this assumption. By simple superficial scarification of the flabby tissue, shrinkage and complete residue of the swellings resulted without scar formation, which can only be accomplished when the swellings are subepithelial and have nothing to do with the proper substance of the cords. For these cases, therefore, scarification is the method of choice, and this treatment is in accordance with the pathological and microscopical findings of these formations.

Such cases hardly ever become autopsy subjects, but it may be assumed almost with certainty that these clinical pictures correspond to the preceding two microscopical findings. Figures 2 and 3, therefore, represent the microscopical, Fig. 4 the laryngoscopical picture of the diffuse subepithelial Reinke's edema of the vocal cords.

Other interesting findings with respect to the pathology of the Reinke's space are brought about by the circumscribed thickenings of the vocal cords as we see them in the polyps.

The laryngeal polyps have undergone various explanations during the course of the development of laryngology. They have been regarded as fibroma, later as cavernous anginoma (Scheyer¹), later as inflammatory hypertrophies of the whole vocal cord (Chiari⁵). Hajek² had in 1925 expressed the opinion that the basic substance of the polyps is completely identical in the principle with the edema



Fig. 4.



Fig. 5.

Fig. 4. Diffuse subepithelial edema of the vocal cords in chronic laryngitis. Laryngoscopic picture.

Fig. 5. Circumscribed subepithelial edema (polyp of the vocal cord). Laryngoscopic picture.

of the subepithelial tissue layer and that the polyps of the edge of the vocal cord represent inflammatory products with secondary changes within this edematous subepithelial tissue.

Two cases are submitted in order to help clarify this question: One of them is a case recently under my observation, the other one an autopsy finding.

S. M., 39 years of age, a furniture manufacturer, became hoarse very suddenly a year ago. He feels a little better now, but a great part of his hoarseness still exists, in spite of various treatments. He smokes about 40 cigarettes a day. The laryngoscopic picture (Fig. 5) is as follows: On the foremost part of the left vocal cord there is a well circumscribed, somewhat pedunculated, and slightly reddened swelling. The remaining vocal cord and the other parts of the larynx are normal. The vocal cords are freely movable. On removal of the swelling by indirect laryngoscopy, the voice became clear immediately, and the normal voice has remained so definitely. The site of insertion of the polyp epithelized within a few days completely and healed without any scar formation, so that later examinations could not locate the spot where the polyp had originated.

The microscopical examination of the removed polyp (Fig. 6) shows in a loose edematous basic connective tissue (B) several spaces

of different sizes filled with hyaline and thrombotic material (H). Numerous dilated vessels and vascular channels (D) are visible, between them hemorrhages and accumulation of old blood. Epithelium (Ep) covers the tumor almost completely, except at the site of removal (C) and a small area in the circumference, at both of which places the underlying edematous connective tissue is diffusely infiltrated (I) with polymorphonuclear neutrophil cells as a sign of inflammation. Neither muscular tissue nor glands are to be found throughout the whole section; the elastic stain shows the absence of any accumulation of elastic tissue.

The polyp, therefore, consists in its main mass of chronically inflamed edematous tissue, and among all its various pathological changes lacks two constituents: muscular and elastic tissue. Consequently, the conclusion is justified that it has developed from a part of the vocal cord which does not contain muscular and elastic tissue; that is, only the subepithelial Reinke's layer.

The extensive pathological changes in the interior of the polyp are secondary chronically inflammatory changes as described already by Chiari.⁷

This finding, therefore, substantiates Hajek's opinion that the polyps are circumscribed inflammatory products of the edematous Reinke's space.

But complete proof can only be given when one succeeds in examining a polyp together with the vocal cord, as Hajek and Chiari have done. In the following (Fig. 7) such a case is represented which is attributed to a rare accidental finding during an autopsy. The polyp itself shows the same changes as the preceding case; in an edematous basic tissue (B), dilated vessels (D), hyaline and organized thrombi (H), and leucocytic infiltrations (I) can be recognized; no muscular or elastic fibers. The whole polyp is covered by the continuation of the epithelium (Ep) of the vocal cords. The substance of the polyp continues, without limit, into the subepithelial tissue of the vocal cord (S) in a kind of pedicle and grows out of this subepithelial tissue between the epithelium and the muscle. It is distinctly discernible that the musculature takes no part in the forming of the polyp, and neither does the elastic tissue of the cord.

The polyp of the vocal cord, after this finding, is definitely to be regarded as circumscribed chronic edematous outgrowths of the Reinke's layer.

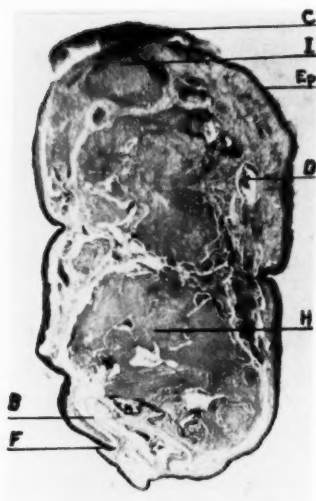


Fig. 6. Microscopic picture of the polyp of Fig. 5. C—site of removal; I—leucocytic infiltration; Ep—epithelium, interrupted only at C and F; D—dilated vessel; H—hyaline and organized thrombi; B—edematous basic tissue.

(In accordance with this finding are also the clinical results after proper removal of the polyp on its pedicle. No visible scars result as would be the case if it originated from the substance of the cord.)

The foregoing cases deal with the diffuse and circumscribed edema of the subepithelial layer. The following three examples concern other pathological changes of this layer.

Figure 8 is a frontal section through a tuberculous vocal cord. The patient had died of a severe pulmonary tuberculosis and had been slightly hoarse for the last six weeks before death. The laryngoscopic examination had shown a superficial ulcer on the left vocal cord without restriction of the motility of the cord. The microscopical examination shows the epithelium of the vocal cord interrupted in two places (U); below them an edema and tuberculous infiltration (T) with numerous giant cells extending upwards and downwards to the beginning of the glands lateral to the muscula-

ture (M) which is mostly intact. The extent of the infiltration corresponds, completely, to the extent of Reinke's space. The subepithelial infiltration has deformed the external contour of the vocal cord.

No matter how the infection has been brought about, whether from the surface or much more likely from the blood vessels of the subepithelial space, the tuberculous infiltration has spread first in this space, and has been checked temporarily at the boundaries of this space. It is not impossible that the edema of the Reinke's space, which accompanies the infection, plays a preparatory and important role in the location and propagation of the tuberculosis of the vocal cord.

Figure 9 shows a vocal cord in a case of lymphatic leucemia. The epithelium is completely intact. Subepithelially between epithelium and muscle, the superior portion of the vocal cord is densely infiltrated (I), which can be seen distinctly also in the black and white photography. The localization of the infiltration corresponds entirely to the superior part of the dilated Reinke's space and continues subepithelially into the ventricle. The inferior part of the vocal cord is free and the muscle (M) intact. In this case, therefore, the entire Reinke's space is not affected, but only the superior part. The explanation can be seen with probability in the distribution of the lymph tissue of the vocal cord which is localized mainly around Morgagni's ventricle.

On the basis of such findings, two sections can be differentiated in Reinke's space, one containing lymph tissue, and the other free from lymph tissue. The former extends from the free margin of the cord horizontally towards the ventricle, the latter from the free margin vertically downward in a subglottic direction. We shall name the former the ventricular; the latter, the subglottic part.

In the leucemic infiltration, therefore, only the ventricular part of Reinke's space participates. A similar localization is to be expected in all inflammatory affections of the lymphoid tissue of the larynx (infections of the "laryngeal tonsil"), and further research in this direction will be of interest.

Figure 10 is a cross-section through a carcinoma of a vocal cord in a rather early stage. The patient had a small spindle-shaped thickening. Superficial erosion in the anterior part of the right vocal cord had been observed clinically for three months, and the tumor had hardly grown in this time. The patient refused the operation at first, but eventually agreed to it after a biopsy had

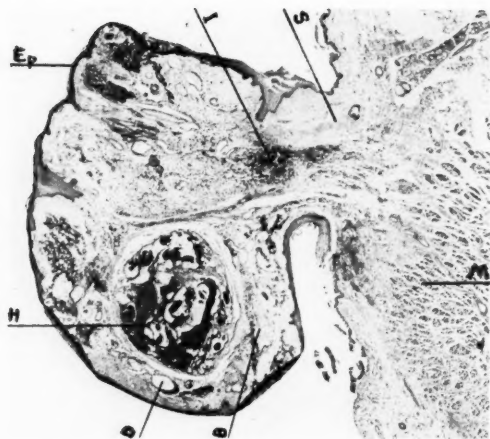


Fig. 7. Polyp in connection with the vocal cord. Photomicrograph of an autopsy specimen. *Ep*—epithelium; *H*—hyaline thrombi; *D*—dilated vessel; *B*—edematous basic tissue; *I*—leucocytic infiltration; *S*—subepithelial layer of the vocal cord from which the polyp originates; *M*—muscle of the vocal cord.

shown a positive result. The vocal cord was still mobile and no glands existed. The tumor was removed by the laryngofissure route radically and then microscopical sections were made of the tumor.

One can see very distinctly the end of the normal epithelium (*Ep*) and the beginning of the carcinoma (*C*) and from a certain point (*P*) can recognize the spread in depth of this carcinoma. It nowhere reaches the musculature, which is displaced by edema and can no longer be seen in the picture. The carcinoma does not pass, in any place, beyond the boundaries of Reinke's space. The same is true with all other sections of the tumor. Two points are remarkable: microscopically, the spreading of the carcinoma in the slightly edematous Reinke's space without penetrating into other parts of the vocal cord in this early stage; clinically, the slow growth and the absence of the infected glands. Both findings have a causal connection. Already Reinke's experiments have shown the boundaries of this space and the fact that, even under application of great pressure, these boundaries were hardly transgressed by the injection fluid. They are to be regarded as a barrier. Concerning the lymph vessels

of this space the findings of Most⁶ are of importance, who, under the epithelium of the vocal cords, could find almost no lymph vessels.

SUMMARY AND CONCLUSIONS

Between the epithelium of the vocal cords on one hand and the elastic and muscular tissue on the other hand, there exists a very thin layer of loose connective tissue which can be artificially injected and is immensely capable of expansion, which Reinke was the first to point out.

A series of pathological changes are shown which take place in Reinke's space.

One of the most typical of these changes is the diffuse sub-epithelial edema of the vocal cords which may occur in various process in and surrounding the vocal cords; for example, in the cases discussed here, a carcinoma of the ventricular cord, trichinosis of the vocal cord, and also as an affection *sui generis* in chronic irritation of the vocal cord.

The polyps of the vocal cords have the same basic substance as Reinke's layer and are characterized, like this layer, by a lack of muscular fibers and elastic tissue and are growing out of this layer under a common epithelium.

They are to be regarded as circumscribed edema of Reinke's layer with secondary inflammatory changes. The submitted findings confirm Hajek's theory of the nature of laryngeal polypi.

The tuberculosis of the vocal cord can originate from Reinke's space. It fills it and remains temporarily limited in this space before spreading. Whether or not this is a rule and what role Reinke's space plays in the localization and growing of the tuberculosis of the vocal cord, can only be revealed by further examinations.

In the leucemic infiltration of the vocal cord, likewise, the Reinke's space is affected, but only in its upper part adjacent to the ventricle. For the acute inflammations of the lymphoid tissue of the vocal cords the same localization can be assumed.

The carcinoma of the vocal cords develops in its early stages only toward Reinke's space. A transgression of this area is barred in these stages by barrier-like boundaries and lack of lymph vessels in Reinke's space. Both explain the very slow growing and



Fig. 8.

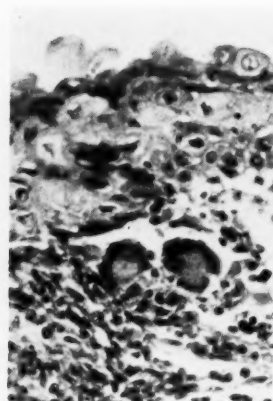


Fig. 8a.

Fig. 8. Tuberculosis of the vocal cord. Frontal section of the cord. Hematox. eosin stain. *Ep*—epithelium; *T*—subepithelial tuberculous infiltration, filling Reinke's space; *U*—ulceration; *G*—glands; *M*—muscle, intact.

Fig. 8a. Enlargement of area marked with square in Fig. 8. Two subepithelial tuberculous giant cells within the infiltration.

very late affection of the lymph glands in carcinoma of the vocal cords.

The results from the examples discussed here show that there exists a real pathology of the subepithelial layer of the vocal cords, that various formations and processes of the cords originate from this space, develop entirely in this space or are limited to it in early stages before they affect other layers of the larynx.

The knowledge of these anatomical and pathological conditions is of importance for the clinical diagnosis, prognosis and therapy of the diseases of the vocal cords.

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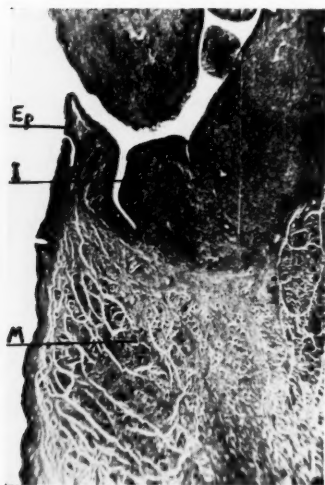


Fig. 9. Lymphatic leukemia. Frontal section of the vocal cord. Hematox. eosin stain. *Ep*—epithelium; *I*—leucemic infiltration affecting the superior (ventricular) portion of Reinke's space; *M*—intact muscle.

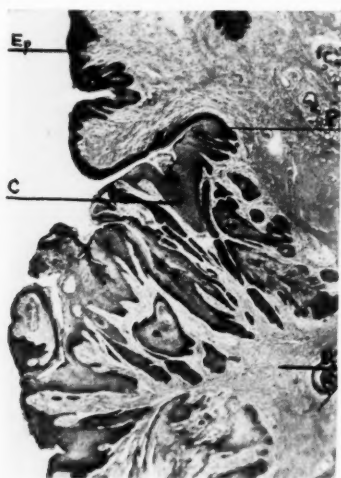


Fig. 10. Carcinoma of the vocal cord, rather early stage. Frontal section of the cord. Hematox. eosin stain. *Ep*—normal epithelium; *P*—end of normal epithelium, beginning of carcinoma; *C*—carcinoma; *R*—sub-epithelial layer not affected by carcinoma; *M*—beginning of muscle fibres.

XLIX

LARYNGOCELE VENTRICULARIS*

J. R. LINDSAY, M.D.

CHICAGO

The term laryngocele ventricularis in man refers to an air sac which sometimes develops from the appendix or saccus of the ventricle of the larynx. The appendix of the ventricle is a constant anatomical finding in the human, varying in size from a simple pit or depression near the anterior end of the ventricle, to a narrow prolongation extending up to the upper level of the thyroid cartilage or, in rare cases, even higher. The structure is well developed in fetal life and infancy, but later lags behind the ventricle in growth.

Laryngocele or cystic dilatation of this structure in man is a rare condition. It has been found to develop in three ways. The most common is said to be the internal laryngocele, a cystic dilatation appearing within the larynx, above the false cord, sometimes extending to the aryepiglottic fold or even to the base of the tongue (Freer).¹ The cyst dilates on forced expiration and if large may produce obstruction. It deflates on quiet respiration, but may persist for some time. Hoarseness accompanies dilatation of the sac.

The second type is the superior external laryngocele, in which case the sac has perforated through the thyrohyoid membrane and appears as a swelling in the neck. The swelling enlarges on coughing, on physical exertion with the upper extremities, or straining at stool, and can be emptied by pressure, when the sound of escaping air, or air and fluid if the sac is infected, may be heard. Distention of the sac may be accompanied by local discomfort and headache, due to pressure on the large veins in the neck. If there is no accompanying internal laryngocele the voice will not be impaired. Infection and accumulation of fluid in the sac is likely, with resultant coughing and expectoration of pus when the sac is compressed. The external laryngocele can be satisfactorily dealt with by surgical removal.

*From the Department of Surgery, Division of Otolaryngology, of the University of Chicago.

Presented before the Chicago Laryngological and Otological Society, January 8, 1940.

The third type is a combined internal and external laryngocele such as reported by Shambaugh² in 1915. In such cases the surgical treatment is complicated inasmuch as removal of the external part of the sac must be combined with an intralaryngeal operation to remove the internal laryngocele. Lewis³ recommended splitting the thyroid cartilage in front of the superior horn as the best means of exposing and removing the intralaryngeal part of the sac.

A fourth type has been described as inferior external laryngocele, but verification of this type by dissection or operation appears to be lacking.

Laryngocele in man was apparently first described by Larrey,⁴ a French army surgeon, in 1829, who found the condition in certain of the blind, who had been employed to chant verses of the Koran from the top of the minarets every hour, and also in the case of two army officers who had been obliged to shout loudly for years. In 1910 von Hippel⁵ reviewed the subject and found 20 cases in the literature, eight of which were discovered postmortem. In 1915 Shambaugh² and Freer¹ reported a case of combined external and internal laryngocele. Additional cases have been reported by Iglauer⁶ in 1920 and by Guerra-Estappé and Süné-Medan⁷ in 1923 who accounted for 35 cases. Additional cases have been reported since then but the total number is still small.

While the appendix of the ventricle is a constant finding in the human, the occurrence of air sacs or cystic dilatations leading from this structure is extremely rare. In many animals, however, laryngeal air sacs are a normal finding. A detailed description of the various types which are found in different animals has been given by Negus,⁸ to whom is to be credited also the modern view regarding their function. He does not agree with the former view that they serve any local purpose but points out that in some instances at least, for example the buccal sacs in frogs, the abdominal sacs in birds and the large external laryngeal sacs in apes, which may extend beneath external muscles such as the pectorals, they serve as rebreathing apparatus, thus providing a more efficient respiratory apparatus and enabling the animal to hold its breath longer. However, in cases where the sacs have rigid walls, such as the howler monkey, or where the sacs are relatively small, the existence of any respiratory function is doubtful.

The appendix of the ventricle in the human contains lymphoid tissue and mucous glands which undoubtedly help to supply the continuous flow of mucus which is necessary to keep the borders of

the vocal cords lubricated during phonation. The possibility that it may represent a remnant of the large extralaryngeal sacs of some anthropoid apes (chimpanzee, orang-utan) has been suggested by Watkins.⁹ Considerable variation in the size of the saccus is found in different individuals, and although not proven it seems likely that the development of a herniation or laryngocele may occur in those cases where a congenitally long appendix has provided a point of weakness.

A study of those cases described in the literature as well as the case to be reported here indicates that there has been one common exciting factor in all cases, namely, an elevation of the air pressure within the glottis, to which the ventricles are exposed, and therefore the appendices which extend from the ventricles. An abnormally long appendix, extending beyond where it can be supported by the sphincteric contraction of the thyro-arytenoid muscles would predispose toward development of an air hernia, but whether or not any such congenital predisposition exists is not definite.

The position of the true vocal cords during phonation can be observed by direct or indirect examination. The sphincteric action of the ventricular and aryepiglottic folds in closing off the glottis may also be observed by direct and indirect examination and has been clearly demonstrated by the moving picture camera. Important additional information regarding the position and shape of both true and false cords during the performance of certain functions of the glottis, not demonstrable by light photography, is now well demonstrated by roentgenological examination by means of the planograph.

During quiet inspiration with full relaxation there is a broad aperture between both true and false cords (Fig. 1A). This can, of course, be observed by direct or indirect examination of the larynx.

During phonation of the letter "E" the true cords are approximated, while the false cords remain far apart (Fig. 1B). Phonation of "E" on inspiration also shows the false cords to be separated (Fig. 1C).

Closure of the glottis on inspiration may show only the true cords to be in apposition (Fig. 2A) or if the glottis is more firmly closed, both false and true cords come into apposition (Fig. 2B).

This bears out the opinion that the true cords may act as an inlet valve, but indicates also that inlet valvular action of the true cords is supplemented by sphincteric blockage of the upper aperture

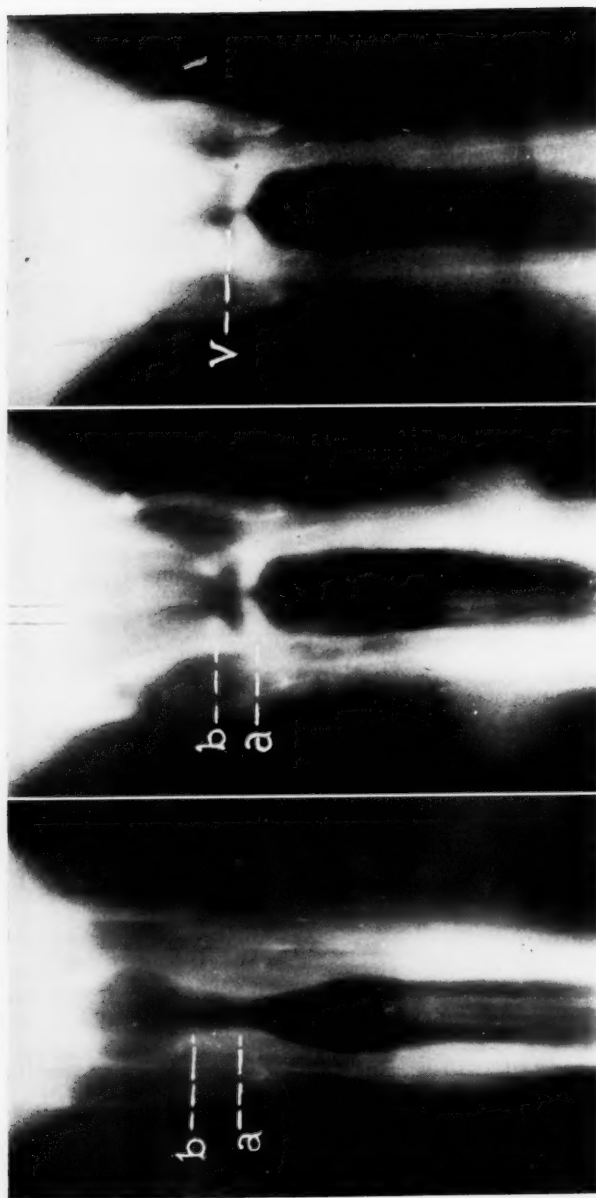


Fig. 1A.

Fig. 1B.

Fig. 1C.

Fig. 1A. Roentgenogram of the larynx and trachea, made by means of the planograph, showing position of the true (a) and false cords (b) during quiet, relaxed inspiration. Fig. 1B. The true cords (a) are approximated and the false cords (b) widely separated during phonation of "E" at a medium pitch and intensity. Fig. 1C. Phonation of "E" on inspiration. The larynx is drawn upward somewhat and the ventricles (V) slightly flattened as compared with Fig. 1B.

of the larynx when firm closure is required. Narrowing of the tracheal lumen takes place as a result of the negative pressure.

While during simple normal phonation, only the true cords are approximated, in certain pathological conditions the false cords may be used for voice production.

During strenuous muscular activity, such as pulling or pushing with the upper extremities, the glottis is firmly closed by both false and true cords (Figs. 3A and 3B). The tracheal lumen is increased in diameter, indicating increased intratracheal pressure. This finding does not agree with the opinion expressed by Negus.⁸ During still more strenuous closure of the glottis, which occurs for example during straining at stool or during severe coughing, both false and true cords are in apposition (Fig. 3C) but in some of the views the ventricle is plainly seen and in some there appears to be more firm apposition of the ventricular bands than of the true cords, as evidenced by the presence of a well-marked notch where the lower margins of the true cords come together. That the intratracheal tension is increased is again indicated by the increased tracheal diameter.

During swallowing the larynx is raised and both true and false cords brought into firm apposition (Fig. 4). Entrance of food into the larynx is prevented by the firm sphincteric closure of the thyro-arytenoid, aryepiglottic and thyro-epiglottic muscles.

The information furnished by roentgenological examination with the planograph regarding physiological action of the glottis seems to indicate definitely:

First, that closure of the glottis during strenuous muscular movement of the upper extremities, during straining at stool or bearing down, and during the early part of coughing before the glottis opens, is brought about partly by closure of the true cords, but to a much greater degree by the sphincteric action of the muscles surrounding the upper aperture of the larynx, namely, the thyro-arytenoid, thyro-epiglottic and aryepiglottic muscles.

Second, that the glottis is closed in such cases to prevent the escape of air rather than to prevent inspiration.⁸ The intratracheal pressure is increased, and the pressure becomes transmitted to the ventricles, apparently because the true cords afford less resistance than the upper sphincter.

Third, that the shape taken by the ventricular bands during apposition as shown by the planograph would preclude any invol-



Fig. 2A.

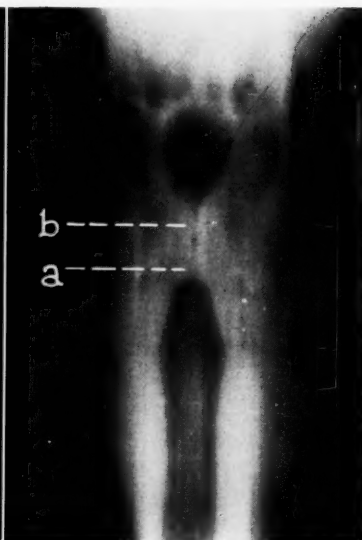


Fig. 2B.

Fig. 2A. Closure of the glottis against inspiration. The true cords (a) are approximated, preventing the entrance of air. The false cords (b) lie slightly apart. The transverse diameter of the trachea is diminished as compared with the same trachea in Fig. 1B, and Fig. 3C, as a result of the decreased intratracheal pressure.

Fig. 2B. Another example of a glottis closed against inspiration. Both true and false cords are firmly held in apposition. The trachea is distinctly narrowed due to decreased intratracheal pressure. Compare with the same case as in Fig. 3A.

untary action as an outlet valve. Closure must be maintained by muscular action. This is probably to be expected inasmuch as any involuntary mechanical action as an outlet valve on the part of the ventricle bands would act against the effectiveness of a cough in clearing the airway.

It appears definite also that in delivering very loud, sharp sounds such as might be required of a military officer or in straining to produce sounds at a high intensity, the intratracheal pressure is increased at the onset of the tone. This is accomplished by closure either at the level of the palate or by closure of the glottic sphincter, or both, and in either case the ventricles will be exposed to the increased pressure since the true cords provide relatively weak resistance.



Fig. 3A.

Fig. 3B.

Fig. 3C.

Fig. 3A. Closure of glottis during moderately strenuous movements with the upper extremities. Fig. 3B. Closure of glottis during more strenuous muscular effort. Fig. 3C. Position of glottis during straining, i.e., in lifting a heavy weight. Note that the glottis is closed firmly at the upper aperture, as well as by the true cords. The tracheal lumen is dilated, due to increased internal pressure. Compare Fig. 3A with the same trachea in Fig. 2B, also Fig. 3C with the same trachea in Fig. 2A.



Fig. 4. Closure of the glottis during swallowing. The larynx is pulled upwards and both false and true cords are in apposition.

The same is undoubtedly true of violent crying, in the expiratory phase, which may be a sufficiently strong exciting factor in a child with a congenital predisposition.

The ventricles are obviously subjected to increased pressures during sneezing and noseblowing, and by such occupations as glass blowing and playing certain wind instruments.

Whether laryngocele develops as a direct hernia through the laryngeal wall, or represents an inherited tendency or develops as a result of a congenital weakness such as an abnormally long appendix, is still a matter for discussion. It appears more likely, however, because of the relative frequency of this condition in young children and in the female, in whom the likelihood of severe straining is less than in the adult male, and because of the anatomical fact (Virchow) that abnormally long appendices do occur, that the condition develops in individuals with a congenital predisposition. The necessary exciting factor, namely, unusually high intraglottic pressures, is one which is common to most individuals.

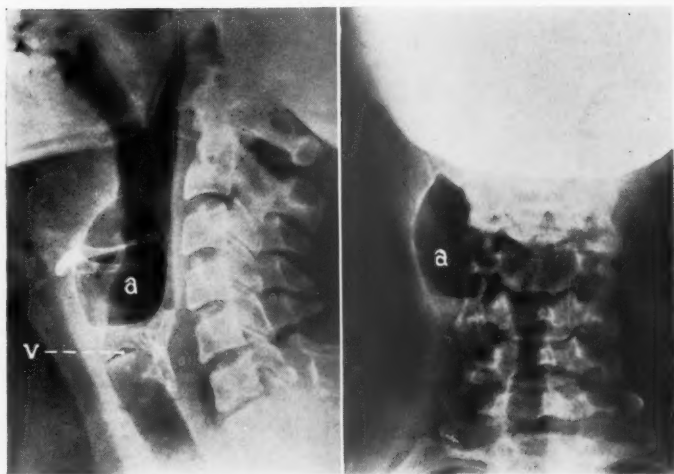


Fig. 5. Laryngocele Ventricularis. Anteroposterior and lateral views showing the air sac (a) lying lateral to the larynx. A quantity of fluid lies in the base of the sac, indicated by the fluid line.

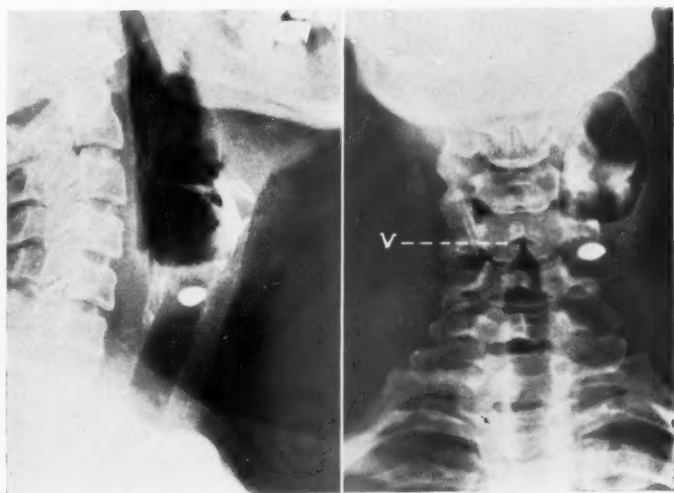


Fig. 6. A small quantity of lipiodol has been injected into the sac. The lipiodol lies in the base, since it is heavier than the fluid in the sac. Some oil has escaped into the tissue in front. The sac extends slightly below the level of the ventricle (V).



Fig. 7. Photograph of the laryngocele shown in Figs. 5 and 6 after removal. Much of the contents had escaped during manipulation.

REPORT OF A CASE

Mrs. L. E., age 38, came to the hospital in December, 1938, complaining of a swelling in the left side of the neck which would puff up on blowing the nose, on coughing, on exertion such as hanging out the washing, on straining at stool, and which on pressure could be made to disappear, accompanied by a hissing sound in the throat.

The swelling first appeared two months previously, at which time the patient's child had bronchopneumonia and she herself had a severe cough. One day she noticed a swelling in the neck after coughing, and since then the swelling had increased. There was no pain when the swelling first appeared, but later she developed an aching pain when it became puffed up. For the past two weeks she had purulent discharge from the throat on pressing over the swelling. On one occasion a few days previously the swelling became very large and could not be reduced by pressure. There had been a steady increase in size of the mass since the onset. There was no hoarseness and no respiratory difficulty.

Examination showed a smooth swelling in the left side of the neck extending up and backwards from the superior border of the thyroid ala. By coughing or straining with the glottis closed the swelling would increase to about the size of a large hen's egg, and could be reduced slowly by pressure and some manipulation. The larynx presented a normal appearance. The true cords were symmetrical and moved normally. The false cords and aryepiglottic folds also were normal, and the hypopharynx presented no abnormality.

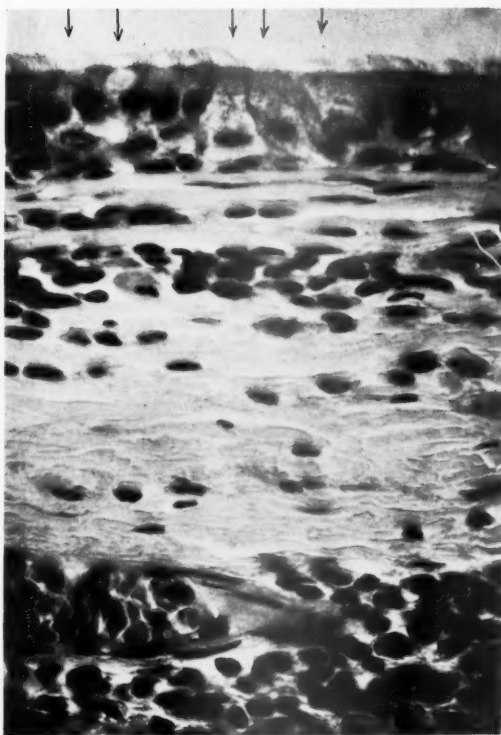


Fig. 8. Microphotograph of a portion of the wall of the laryngocele. The epithelium is pseudostratified ciliated columnar in type, with many goblet cells (designated by arrows), and rests on a thin basement membrane (arrow). The tunica propria consists of moderately vascular fibrous connective tissue.

Diagnosis: Superior external laryngocele.

Roentgenologic examination: The air sac in the left side of the neck was clearly shown (Fig. 5) lying external to the larynx from a level slightly below the ventricle, to above the hyoid bone, a distance of over 4 cm. in height and slightly less in width. The base appeared as a sharply demarcated horizontal line suggesting a small amount of fluid. Later a needle was inserted through the skin into the sac. A sudden jerk of the patient's head caused some oil to escape around the sac. The roentgenogram showed the oil underlying a quantity of fluid, the upper margin of which is clearly seen (Fig. 6). The opening of the sac into the larynx was not demonstrated.

Treatment: Under local anesthesia the sac was removed completely through an incision along a natural fold in the skin just below the hyoid bone. The pedicle was ligated at it came through the thyrohyoid membrane at the upper anterior margin of the thyroid ala just lateral to the notch. The thyrohyoid membrane was very thin. The base of the pedicle was cauterized with phenol, and the muscles and fascia sutured over the area. The platysma layer was sutured and the skin closed with clips. The sac was not opened during the operation (Fig. 7).

The wound healed by first intention and there has been no recurrence of the laryngocele up to the present.

Pathology: The removed specimen consisted of a moderately thin-walled, oblong membranous sac filled with air and fluid (Fig. 7).

Microscopic examination of a section from the sac wall showed an outer layer of fibrous connective tissue containing many dilated blood vessels, lined by pseudo-stratified ciliated columnar epithelium beneath which was a thin basement membrane (See Fig. 8).

SUMMARY

1. The condition of laryngocele in man has been briefly reviewed and a case of superior external laryngocele described. Surgical removal was carried out, with a successful result.

2. Additional evidence regarding physiological action of the true and false vocal cords, and of the intratracheal pressures during phonation, muscular effort with the upper extremities, straining movements, and swallowing, has been furnished by roentgenological examination with the planograph.

3. The exciting factor in all cases of laryngocele in man is undoubtedly abnormally increased intraglottic pressure to which the ventricles are subjected. The occurrence of laryngocele in young children and females and the known occurrence of congenitally long appendices of the ventricle suggests a congenital predisposition as a basic factor.

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A SURVEY OF THE RELATION BETWEEN NUTRITION AND THE EAR

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SAN FRANCISCO

Evidence is slowly pointing to the fact that many conditions of the ear, nose and throat, especially constitutional deafness (nerve and conduction type), sinus infections (allergic or not), and probably enlarged tonsils and adenoids are related to dietary errors and the various factors involved in growth, i. e., endocrine glands, vitamins, mineral salts, amino-acids and meteorological factors.

The etiology of many diseases which was a few years ago either unknown or thought to be due to infections may now be related to nutritional deficiencies. This is true of beriberi, pellagra, Landry's paralysis, peripheral neuritis (including the auditory nerve), many cases of gastrointestinal diseases, gallbladder disease, night blindness, fragile blood vessels, rickets, scurvy, pernicious and other anemias, physical deformities, including deformities of the middle face, fragile or careous teeth, bone and dermal diseases.

In a very recent article in the Journal of the Americal Medical Association¹ entitled "Focal Infections and Systemic Disease," food for thought is offered and suggests that something other than infections is the underlying cause of disease. The dictum of K. F. Meyer of the Hooper Foundation for Research Medicine (University of California Medical School) expressed years ago, i. e., that germs are opportunists and must have a soil properly prepared, holds as good now as then.

In the London Lancet, Dr. Phyllis Toohey Kerridge² has published the results of hearing tests made on one thousand English school children under the age of twelve years. This study represents the findings in both the better fed and poorer fed children. She found that middle ear deafness "is about four times as common on the average under poor social conditions as it is under good

*From the Harriman Research Laboratories, Southern Pacific General Hospital.

social conditions. In the poorest places . . . it may be nearly ten times as common as in a good environment, nearly a quarter of the child population being affected."

The nutrition of these two groups differed materially. "The diets of the children in the group which suffered most from middle ear disease are low in calorific value, in protein (particularly in animal protein), and in vitamins. This coincidence of deficient diet and the high incidence of hearing defects may mark an inter-relationship; but the fault cannot be traced to a specific food component, because so much is lacking in some of the diets." It is quite obvious on looking over the scheduled dietaries of the various groups that there is an excess of carbohydrates, most if not all the vitamins, and a calcium-phosphorus ratio that probably is out of line.

In closing her article, Dr. Kerridge says: "The figures here given show that probably the most important work on the prevention of deafness will be done by those who are striving to improve the social conditions and, in particular, the nutrition of the nation."

A recent survey³ of nine thousand individuals in twelve American cities by the United States Public Health Service in Washington, D. C., shows that fifty per cent are hard of hearing in varying degrees, and that quite a large number of the age of ten and younger show a beginning loss at the upper end of the tone scale and that individuals over the age of twenty show increasing loss over each decade of life.

C. W. Richardson, an otologist of Washington, D. C., many years ago mentioned cases of acute rhinitis occurring among girls in a high-class boarding school which frequently followed week-end visits to their homes where they indulged in excessive candy eating.

I shall never forget the graphic story told me over thirty years ago by the late Joseph A. Stucky of Lexington, Kentucky, one of the most distinguished and far-looking otologists of the times. He described a trip through the mountains of Kentucky, observing the habits of that strange collection of human beings and mentioned the toothless young married women, old far beyond their years; children with running ears and noses, open mouth, large tonsils and adenoids. Their diets consisted largely of hog, hominy and syrup. Stucky, for the balance of his life, preached against the use of refined flour products, jellies, marmalades, and cane sugar products.

Burt Shurley of Detroit, Michigan, who is also an otolaryngologist, probably was the first one to emphasize the metabolic disturbances in his patients and the importance of proper diets.

Both these men were the real pioneers among otologists and antedated most pediatricians and internists in emphasizing that improper food intake was responsible for many of the troubles for which the ear, nose and throat men were consulted then as now.

A recent author⁴ says: "It would not be tampering with the truth to any extent to suggest seriously that fully half of the illnesses and physical maladjustments of so enlightened a race as the Americans are directly or indirectly traceable to preventable dietary deficiencies. This includes everything from constipation to tuberculosis." Much supportive and other evidence is found in the published books of prominent authors. To name a few: McCarrison, "Studies in Deficiency Diseases" (1921); Mellanby, "Nutrition and Disease" (1934); Eddy and Dahlberg, "The Avitaminoses" (1937); Williams and Spies, "Vitamin B₁" (1938); Sure, "The Little Things in Life" (1937); Bogart, "Nutrition and Physical Fitness" (1939); Sherman, "Chemistry of Food and Nutrition" (1937); McCollum, "Newer Nutrition" (5th edition); Rose, "The Foundations of Nutrition" (1938). These are worthwhile books, the reading of which should convince any doubting Thomas.

Huser⁵ in "Science Newsletter" says: "A really enlightened diet will not only prevent so-called deficiency diseases, it will ward off many of the conditions that nowadays make surgical operations necessary." This was observed in McCarrison's day.

The editor⁶ of a recent book entitled "Medicine of the Ear" has this to say under the caption "Nutrition": "Insufficiencies in quality as well as quantity of food may also make patients more susceptible to diseases. Vitamin deficiency in the diet is much more common than is generally supposed. Perhaps the commonest, especially during the winter and early spring, is the deficiency of D. How much the other vitamins have to do with increased susceptibility to infection is problematic." He mentions a book written by Sherman, published in 1937, the title of which was not mentioned, to support the last portion of his comment.

Nowhere else has anything been stressed in this book that I have been able to find regarding the importance of nutritional deficiencies in relation to diseases of the nervous system and peripheral nerves or to diseases involving the mucous membranes and other tissues or organs. Therefore, this paper is written not in criticism of the author of the above-mentioned book, but written with the hope that it may stimulate the otolaryngologists of this country to

further investigation of one of the most fascinating subjects in medicine today—nutrition, as it relates to diseases of the ear, nose and throat.

VITAMIN A IN RELATION TO INFECTIONS

Jean Bogart⁷ in "Nutrition and Physical Fitness" says: "Vitamin A has been called the anti-infective vitamin, but recent scientific work all seems to point to the fact that it protects against the entrance of bacteria by keeping the skin and mucous membranes lining the various cavities or passages in good condition, but is probably not anti-infective in the sense of actually increasing immunity to bacteria once they have invaded the tissues."

She summarizes the more common defects which are related to nutrition as follows, arranging them approximately in order of their frequency: "1) adenoids and enlarged tonsils; 2) infected tonsils; 3) abscessed teeth (not ordinary decay); 4) infections in middle ear or head cavities (sinuses); 5) infected glands in neck; 6) urinary bladder (pyelitis); 7) gallbladder (cystitis); 8) appendix (appendicitis); 9) intestinal tract (ulcers, colitis); 10) reproductive organs (vaginitis); 11) bones and joints (arthritis, rheumatism, osteomyelitis); 12) heart (endocarditis)."

Mary Schwartz Rose⁸ in "The Foundations of Nutrition" says that the lack of vitamin A is very important to the health of epithelial tissues, inducing keratinization. "An adequate vitamin A supply at all times is a means of strengthening the natural defenses of the tissues. After damage due to an inadequate supply has been done, dosing with the vitamin will not guarantee a cure, although it may help to hasten such recovery as the tissues are still capable of."

Dr. S. W. Clausen⁹ of the University of Rochester School of Medicine, studying the influence of vitamin A upon infection in infants found that among three hundred and seventeen cases under thirty-six months of age severe infections were twice as frequent in those whose previous diet lacked vitamin A as in those to whose diet it was added in the form of cod liver oil from the age of three months and also in the form of vegetables containing carotene from the age of six months.

Mellanby, quoted by Eddy and Dalldorf,¹⁰ reported that in ninety-two rats on a vitamin A deficient diet, 44 per cent had infections of the urinary tract; 20 per cent had otitis media; 21 per cent had intestinal inflammation; 9 per cent had pulmonary infections, and 75 per cent of the older animals had abscesses in the floor of the mouth.

VITAMIN A AND THE EIGHTH NERVE

Since 1926 Sir Edward Mellanby has presented a series of articles related to his findings of degeneration in various parts of the nervous system and certain peripheral nerves, especially the eighth, the result of a deficiency of vitamin A in the diet. In his more recent communications¹¹ he details, in addition to nerve changes, the finding of bone thickening in various parts of the petrous bone and the internal auditory meatus. This is a very important observation.

Shambaugh, Jr., has already reported a case of nerve deafness due to pressure of an exostosis in the internal auditory meatus. No mention was made by him of a possible existence of a vitamin A deficiency.

J. T. Irving and M. B. Richards¹² find a "uniformity of degeneration in the medulla."

W. P. Covell¹³ has found the same amount of degeneration in the eighth nerve as described by Mellanby. He made no observations about bone growth.

Several of my nerve cases tested with the Zeiss Photometer showed some loss of light adaptation. No change in the audiometric curve followed the use of carotene. Recently a 16-year-old girl (nerve case) who was deficient in vitamins A, B, the P-P factor and vitamin C showed a marked improvement from the use of carotene. The other factors are being added from time to time.

VITAMIN B IN RELATION TO INFECTIONS

Eddy and Dalldorf¹⁰ say: "Evidence of an association between vitamin B and resistance is less substantial than for A and C vitamins." These authors quote from Robertson's work (page 263) as follows: "Few studies show lowered resistance when infection is super-imposed on animals on a B deficient diet, but this is not evidence of specific ability of vitamin B to combat infection. Obviously, an animal weakened by prolonged inadequate dietary regime of any sort is less liable to mobilize the defensive mechanisms."

Perla,¹⁴ in an elaborate review of the literature in "Vitamin B and Resistance," presents a striking array of data indicating the value of an optimum intake of the vitamin B complex in the diet. On page 552 is stated: "There are numerous observations in clinical medicine of the effects of vitamin B deficiency on resistance to infection. The concomitant prevalence of dietary and infections that

reach epidemic proportions in certain Asiatic countries is striking." He quotes McCarrison, who "maintains that in India deficiency of vitamins in the food, particularly of vitamin B, is an important factor in the causation of gastrointestinal disorders and infections, mucous diseases in children, and colitis in adults."

"Vitamin B in excess increases the natural resistance to staphylococcal infection in man and is useful in the treatment of furunculosis and acne." Further on, he states: "It may be that in human beings the enormous variability in allergic response to proteins is in part due to variations in the deficiency of vitamin B in the dietary."

Matzger,¹⁵ allergist to the Southern Pacific General Hospital (San Francisco), has stated that he has had better results in food allergic asthma cases by the giving of the rice bran B complex and making no effort to alter the dietary intake.

Perla gives us much information on the resistance of experimental animals on diets rich in vitamin B₁ to the virus of yellow fever, leprosy, parasitic disease, etc., and to diets rich in the total B complex in bacterial infections (staphylococcus, aureus, diplococcus, pneumonia, welchii, etc.).

Gyorgy¹⁶ has emphasized the relation of B₆ to certain anemias and other literature is replete with the clinical value of the B complex in skin lesions, muscles, vascular, and above all, involvement of the nervous system and peripheral nerves, its great value for the health of the pregnant mother and the offspring, to contravert the opinion that the value of other vitamins than D are not important in infections.

Anyone who has followed the histories of cases with recurrent infections of the upper respiratory tract over a period of years is impressed with the fact that better nutrition means lessened periods of most of the infections occurring during the life of humans because storage of the vitamin B complex is very limited and soon lost during the period of illness.

VITAMIN B AND THE EIGHTH NERVE

The studies of the eighth nerve by Covell were made on rats and chicks furnished by the Department of Biological Research of the University of California under Professor Herbert M. Evans, and by the Department of Animal Husbandry of the University of California through the courtesy of Dr. T. Jukes. These rats and chicks were deficient in vitamin B₁, riboflavin, B₆, and the filtrate factor of

Jukes which is now known as pantothenic acid. Studies are in progress at the present time on the black tongue dog and the Agnes Fay Morgen gray haired rat factor. Much is hoped for in this latter factor, because in these animals are many changes analogous to ageing in man: gray hair; atrophy of the skin; atrophy of the gonads, adrenal cortex, etc.

Covell's¹² findings of changes in the nerve and cochlea were sufficient to warrant the clinical use of the total vitamin B complex and thiamin chloride and nicotinic acid, when available. Some noteworthy changes (improvement in hearing) have been observed with these two fractions. Further experimentation with other fractions of the B₂ complex, when they are available in synthetic form, in those cases already under treatment, may show further improvement. Undoubtedly the future will produce a stronger B₂ complex than is obtainable today, and when more is known about the synthetic B₆, pantothenic acid and the other filtrate factors in the gray hair fraction, a more perfect answer can be given regarding the B deficiency and the peripheral nerves (eighth, etc.).

VITAMIN C

This vitamin has long been in the limelight since the discovery of the relationship of scurvy to lack of citrus fruits and ages before its isolation by Szent Gyorgi. It is now recognized as the inter- and intracellular cementum and its deficiency, according to Rose in "The Foundations of Nutrition" is the underlying cause of:

- 1) The hemorrhages which may occur anywhere in the body;
- 2) Profound changes in the structure of teeth and gums;
- 3) Changes in the growing ends of the bones with beading and other deformities were mistaken for rickets;
- 4) The falling apart of bones due to loss of supporting cartilage;
- 5) The enlargement of the heart and damage to the heart muscle;
- 6) The degeneration of muscle fibres generally causing extreme weakness and even death;
- 7) The profound anemia due to destruction of blood forming cells in the bone marrow and loss of blood by hemorrhage;
- 8) Loss of calcium through degeneration of the bone matrix so that it is no longer able to retain the mineral salts and the bones become soft—they break spontaneously;
- 9) The degeneration of the sex organs.

Hess⁸ calls attention to the fact that in infants one of the striking and important symptoms of scurvy is susceptibility to infections.

Rinehart¹⁷ describes swollen joints filled with fluid, adhesive bands, decalcification of bones, rheumatic heart, occurring in guinea pigs in vitamin C deficiency.

Adams¹⁸ tells of thirty-two asthmatics of finding practically no vitamin C excreted in the urine.

Rosenberg¹⁹ considers the possibility of dietary deficiency as an etiological factor in asthmatics. In many cases the vitamin C was low in the blood and addition of citrus fruits to the diet relieved the condition.

Cases of hay fever show low normal blood C and several cases of perennial hay fever have had their nasal symptoms cured by large doses of cevitamic acid (150 mg. to 600 mg. daily). These cases have been my own.

VITAMIN C AND THE EIGHTH NERVE

Covell¹² has called attention to intracellular edema in his study of the internal ear in C deficient guinea pigs. He has been able to confirm Ono's²⁰ findings, i. e., degeneration of the eighth nerve, except for decalcification of various areas of the petrous bone and the ossicles. These findings await confirmation by other animals. These findings of Covell confirm the suspicion of one of Dederding's²¹ co-workers that one of the underlying factors in Ménière's disease was probably an intracellular edema of nutritional origin.

Criep²² says: "The pathology and physiology is in all likelihood an edema of the various structures in the internal ear."

Adam²³ reports the finding of very low vitamin C in the urine of several patients with recovery of his cases from the use of ascorbic acid (fruit juices) by mouth and parenterally. Adam also says: "In four cases Ménièreism has been associated with deficient intake of vitamin C and has been cured in three, largely by attention to vitamins. In the fourth case seen in 1936 the attacks were severe, sometimes causing unconsciousness; the blood pressure was subnormal. This lady has had much domestic strain and had, owing to heartburn, taken little fresh fruit. But on my suggestion she has persevered, and though there is still distinct tinnitus and deafness in the left ear, the giddiness had disappeared."

"Defective intake of the vitamin B complex may be an important factor in Ménière's." Kuczynski²⁴ showed many years ago that this vitamin and fat in combination are essential for the function of Nissl granules in nerve cells; if there is a lack, chromatolysis ensues. But the paramount importance of vitamin C is related to the high content of adrenals in this vitamin.

Chimani²⁵ mentions eighteen cases of chronic middle suppuration who were given large doses of vitamin C in addition to conservative local treatment; most of these cases showed considerable deficiency of this vitamin. In ten instances, the suppurative process ceased, the ear becoming dry. An improvement of the otoscopic picture and a lessening of the discharge was observed in the remainder. Study of the middle ear mucosa of one pig to whom was given 1800 mg. of redoxon gave a definite reaction for vitamin C, showing that the middle ear mucosa stored this vitamin.

Bernfeld, Feilchenfeld and Hirsch²⁶ have reported the study of fifty-three children. The cases concerned were those of chronic otitis media with a small central perforation and a typical non-specific mucous membrane disease. Excluded were the cases of specific infection and those of cholesteatoma. The pus from the middle ear of the chronic otitis media cases contained streptococci, pneumococci, bacteria proteus, bacteria pyocyanous, or other common organisms. A considerable number of the cases fell under the classification of exudative diatheses. Fifty-three children were studied for 1) general clinical findings; 2) vitamin C. The vitamin C content of the urine was determined in each instance by means of the saturation method.

Fifty per cent of the fifty-three children between the ages of six months and ten years showed decreased resistance and were in poor nutritional condition. More than 30 per cent showed tonsillar foci and adenoid vegetations. In the majority of the cases the suppurative otitis had lasted for one to three years. In more than 50 per cent of the cases of chronic otitis there was a marked deficit of vitamin C output. In a series of children living under the same conditions but suffering from acute otitis media, a normal vitamin C output was found in nearly all of the cases.

A questionnaire was sent by myself to sixty members of the League of the Hard of Hearing in San Francisco to find out the dietary and tooth history. The replies showed that there had been practically no intake of citrus fruits during most of their lives and that fully 50 per cent had defective teeth. In another series of cases

a complete laboratory study of all the electrolytes and the blood vitamin C showed that 45 per cent of the cases of conduction deafness were below the accepted upper normal range. A case of nerve deafness recently reported had a low vitamin C content. The patient's hearing became normal following treatment with cevitamic acid. Another case of Ménière's disease had a vitamin C content of 0.25 mg. per cent (normal, 0.8 to 1.5 mg. per cent). This patient had also a low B₁ finding and the blood vitamin A was 30 per cent below normal.

This brief review of vitamin C suggests the great value of its determination in all cases of eighth nerve and conduction deafness and all allergies.

VITAMIN D

The deficiency of this vitamin in relation to rickets and the use of cod liver oil in its treatment has been known for ages.

C. T. Reid, A. C. Struck and T. E. Steck²⁷ in "Vitamin D" say: "The great interest evident in recent years in the therapeutic use of vitamin D in treating infections had its origin in two generalizations. First, the incidence of infections is generally held to be greater in rachitic than in non-rachitic subjects. Second, it has been recognized for a long time that ultra-violet light has a marked bacterial effect and also increases the resistance to infections in the organism."

"There was quite general agreement in the reports that the incidence of spontaneous infections was greater in both experimental vitamin D deficiency and clinical rickets, although even here there was some disagreement."

"Thompson investigated the incidence of spontaneous infections of the middle ear and lungs in rats and found that the incidence was increased when the diet was deficient in both vitamin D and iodine. The author implies that the addition of iodine had more influence in improving the incidence than vitamin D."

It has been shown by Agnes Fay Morgan²⁸ that dogs deficient in vitamin A but fed large doses of D₂ show extensive loss of calcium from the bones and followed by extensive deposits of kidney and bladder stones as well as calcium deposits in other tissues of the body. The ears of these dogs will be studied shortly.

Covell²⁹ has studied the eighth nerve, etc., in vitamin D deficient animals and says: "Avitaminosis D results in unripe bone which

is to be found in the periosteal and enchondral layers of the labyrinthine capsule. Some osteoid bone is also to be found in the modiolus. The cochlear nerve shows slight to moderate amount of demyelination. Weber produced generalized osteodystrophia fibrosa in dogs on a low calcium diet with lack of cod liver oil. The enchondral and periosteal layers were affected with some encroachment upon the endosteal layer."

"Hypervitaminosis D₂ (irradiated ergosterol) results in new bone formation in the periosteal layer; particularly of interest is new bone formation in the internal auditory meatus, about the ossicles, the middle ear muscles. The bone of the labyrinth is very compact with only a few marrow spaces. The endosteal layer remains unchanged."

VITAMIN E

Bicknell³⁰ says that a plentiful supply of vitamin E should be used in epidemics of infantile paralysis as a protector of brain cells. He treated cases of muscular dystrophies, amyotrophic lateral sclerosis, peroneal muscular atrophy, amyotonia congenita and nerve and muscular disorders. All his cases except one showed improvement.

Covell expects to study the ears of Evans' deficient E animals to note especially if there is atrophy of the stapedius and tensor tympani muscles. Should such be found, it is possible to correlate the findings of a group of 148 deafened humans, 50 per cent of whose urines showed an increased output of creatine.

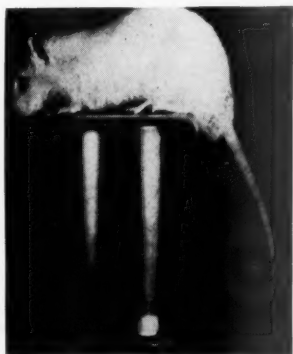
Inasmuch as vitamin E plays such an important part in the life cycle, intensive study should be carried out in patients described by Bicknell and Wechsler³¹ to determine what symptomatology present in the ear, nose and throat might be related to deficiency of this vitamin. None of Evans' animals deficient in this vitamin show any special liability to infections.

COMMENTS

The preceding text has referred only to the question of the several vitamins in relation to infections, and their influence on the auditory apparatus. The evidence submitted seems to support the idea that an optimum diet containing all the essential factors reduces very materially the tendency to cold-catching. All the vitamins are essential during acute infections, and although they may not shorten the period of infection, the final end shows the average patient in far better general physical condition than they would

otherwise have experienced. No reference has been made as to the importance of the electrolytes, amino-acids, endocrine glands, and the necessity of keeping all these factors in mind and their relation to nutritional deficiencies.

The following animal pictures show that a deficiency of any of the electrolytes interferes with normal growth. This applies equally with animals or chicks deficient in any of the vitamins.



Normal Rat



Magnesium Deficient Rat



Calcium Deficient Rat

A fitting conclusion to this subject is found in a recent book by Barnett Sure,³² who has presented in popular style for the public the story of the discovery of vitamins and hormones in relation to health and disease. It is entitled "The Little Things in Life" and the central theme of it is this: "Since they can make or break the human organism, the little things in life are actually the big things in life," and so they may also finally aid in the solution of the perplexing problems which today confront us.

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LI

CARCINOMATOSIS OF THE NASAL MUCOUS
MEMBRANE*

(FATAL HEMORRHAGE AFTER PUNCTURE OF
MAXILLARY SINUS)

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AND

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Malignant tumors arising within the nose or the paranasal sinuses are by no means rare occurrences, and their diagnosis as a rule does not meet with great difficulties. However, metastatic tumors of the nose are extremely rare, as stated in all textbooks of rhinology. We found in the literature of the last ten years only four cases of metastatic hypernephroma in the paranasal sinuses.¹

The following case presents the findings of a metastatic malignancy of the nasal mucous membrane, but without development of tumor-like formation. Therefore, the case cannot be dealt with as an interesting case alone since a thorough examination revealed findings which increase our knowledge regarding the pathology of the nasal mucous membrane to a remarkable extent. The case was as follows:

A 54-year-old white male came to the Research Hospital stating that with the exception of an occasional cold each winter, he had been in good health until about three weeks previously. At this time, he noticed a soreness over the right side of the nose, but there was no manifestation of a cold. The following day, this area became the seat of severe lancinating pains which spread to the right side of his forehead, his right eyeball, and over his right parietal

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region. He also was aware of a feeling of weakness accompanied by generalized muscular pains, more pronounced in his back. He consulted his physician who diagnosed it as a sinus condition and treated him with short wave therapy. Several days later he began to see double upon looking forward and to the left. He also noticed that his right eye began to protrude. These symptoms continued for several more weeks, whereupon he came to the hospital seeking further advice.

A physical examination revealed him to be a well-developed but poorly nourished and markedly cachectic man not acutely ill. B. P. 100 60, T. 99.4, P. 88, R. 22. These were the essential findings: (1) In the right eye there was an external oculomotor nerve paralysis, with a moderate exophthalmos; the pupils, however, reacted to light and accommodation. (2) The nose was apparently normal, except for a moderate deviation of the septum. (3) The epipharynx contained a small amount of mucoid discharge. (4) Transillumination revealed a clouding of the right frontal and maxillary sinuses. (5) X-ray corroborated the transillumination. (6) Internal examination did not reveal marked pathology.

Our first impression was that of a right pansinusitis. At the next examination, a puncture of the right antrum was made under the inferior turbinate, and a small amount of pus with much bleeding was obtained. In making the puncture, however, a soft lateral nasal wall was felt, giving the impression of a soft tumor-like mass within the antrum. The extreme pallor of the patient and his back pains, in addition to the "butter-like" consistency of the nasal wall, pointed either to a carcinoma with multiple metastases in the skeleton or a myeloma. Following the puncture, the patient had no complaints except for a small amount of bleeding, which was controlled by a nasal pack; and he returned to bed apparently in good condition. That afternoon severe epistaxis occurred, but this again was easily stopped with nasal packings. The patient, however, showed signs of internal bleeding, his pulse becoming weak, thready, and rapid and his blood pressure dropping. He then began to vomit large amounts of fresh blood. Repeated examination of his nose, however, failed to show any bleeding, so that a hemorrhage originating in the stomach was considered. These symptoms continued, and in spite of two blood transfusions, stimulants, and intravenous fluids, he became comatose and died the following morning, about 24 hours after the puncture of his sinus. An autopsy was performed and the anatomical diagnosis was as follows:

1. Diffuse carcinoma of the lesser curvature of the stomach with metastases to the liver, regional lymph nodes, meninges and calvarium.
2. Hemorrhage from carcinoma of the stomach.
3. Suppurative maxillary sinusitis, right.
4. Patchy atelectasis of lungs, bilateral.
5. Old healed tuberculosis of apices of the lungs.

Gross examination revealed in the head, which is of utmost importance to us, an area of softening in the inner table of the parietal bones near the mid-sagittal suture in which the bone appeared to be partially replaced by soft, pale red tumor tissue. The venous sinuses of the dura contained partially clotted blood, and lying in the superior longitudinal sinus were several soft nodules measuring up to 3 mm. in diameter, which appeared to resemble the tumor tissue found elsewhere. The brain weighed 1560 gm.

The brain appeared to be normal with the exception of the tip of the right temporal lobe and along the Sylvian fissure on the right side where the arachnoidal membrane was thickened and had a yellow discoloration. The dura mater came away cleanly from the arachnoidal membrane, but on the undersurface of the dura mater there was a reddish granular diffuse thickening over both cerebral hemispheres. The dura over the right middle cranial fossa was covered by an irregular layer of partially necrotic tumor tissue which extended posteriorly as far as the petrous temporal bone. The middle ears and mastoid air cells appeared normal throughout. With the exception of the right maxillary sinus, the accessory nasal sinuses were empty and contained a normal glistening mucous membrane. The right maxillary sinus was filled with thick purulent material with only shreds of the mucosa remaining, and these were of a mottled, dark gray color. The sphenoid sinuses contained a few small polypoid masses, 3 mm. in diameter.

MICROSCOPIC EXAMINATION

Mucous membrane of the middle turbinate: The epithelium layer was well preserved. It was normal and contained in some places very many goblet cells. The basilar membrane was, as a rule, not very well differentiated; in some places there was only a thin layer of dense connective tissue beneath the epithelium layer. The connective tissue showed, in some places, a dense infiltration of lymphocytes, while in others the lymphocytes and plasma cells were

loosely scattered in the connective tissue. The majority of the glands were normal and evidenced a marked activity. There were, however, some very interesting changes to be found in some glands lying close beneath the epithelium and in some of the secretory ducts (Fig. 1). In these places the size of the glandular cells increased markedly, so that the opening of the gland or of the secretory duct diminished or disappeared entirely. Simultaneously the nucleus became smaller, resembling sometimes a pyknotic nucleus, and it lay near the center of the cell. The protoplasm was granular, oxyphil, and the margins of the cells were occasionally not very sharply defined. The discrepancy between the size of the protoplasm and the size of the nucleus made it obvious that occasionally a section cut through the protoplasm without touching the nucleus. In that case, one found in the specimen a disk of protoplasm without a nucleus (Fig. 2). Within the little veins and lymph vessels there were accumulations of large nuclei presenting a net work of chromatin and occasionally mitotic figures (Figs. 1 and 3). The margins of these cells were, as a rule, not very distinct. These cells formed either compact emboli which blocked the vessel partially or entirely and which apparently grew together with the wall of the vessel (Fig. 4), or they were loosely scattered within the lumen of the vessel, the latter being the unusual occurrence. These cells were also to be seen in the connective tissue between the bony plates of the turbinate and the ethmoid. In no place did these cells perforate the walls of the vessel. The cells were not present in the arteries and in the large veins of the corpus pseudocavernosum. The mucous membrane was not edematous. The bone of the turbinate and the ethmoid was normal, as far as could be seen in the specimen. The margins of the bone showed a blue "Haltelinie" or stop-line indicating that there was neither apposition of new bone or resorption going on at the time of death. In some pneumatic cells of the ethmoid there was a muco-serous exudate.

Mucous membrane of the inferior turbinate: The changes were essentially the same as in the middle turbinate. However, the basilar membrane was readily seen. Furthermore, there were emboli composed of carcinoma cells present within the large spaces of the corpus pseudocavernosum (Fig. 1).

Mucous membrane of the maxillary sinus: There was a very marked chronic inflammation of the mucous membrane which was deprived of its epithelial layer. There were some pieces of bone imbedded in the mucous membrane which were normal.



Fig. 1.

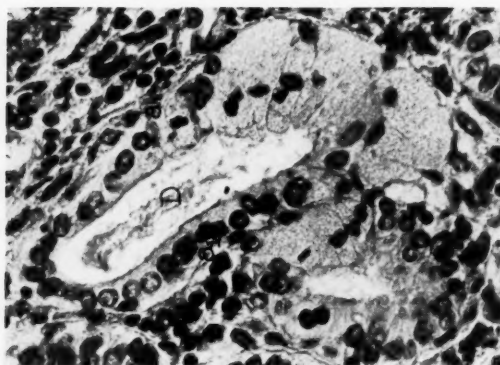


Fig. 2.



Fig. 3.

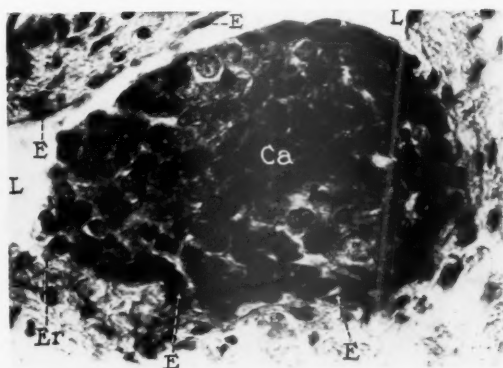


Fig. 4.

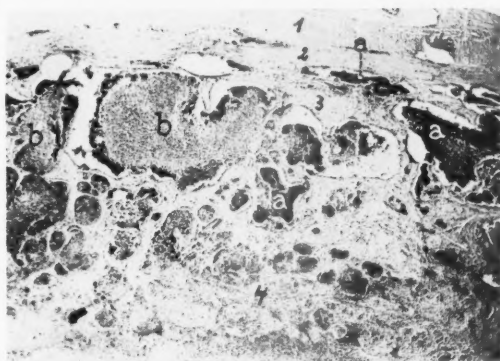


Fig. 5.

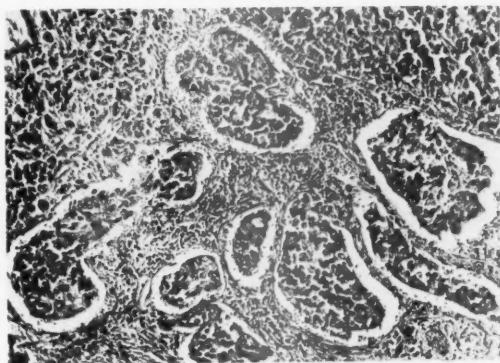


Fig. 6.

Dura: The dura showed its internal and external layer to be normal except for emboli of carcinoma cells which were found in some of the larger veins of the dura (Fig. 5). The internal layer passed into a layer which Russel and Cairns² call areolar layer of the dura and which consists of large blood vessels with septa of connective tissue between it. Almost all the blood vessels of that layer were filled either with carcinoma cells alone, or with large thrombi, the surface of which was covered by a film of carcinoma cells. The areolar layer passed into another layer which had the appearance of a subdural false membrane. It consisted of large blood vessels which were entirely filled with blood. Only in a few of the vessels were there some carcinoma cells. Between these blood vessels there was a very dense layer of carcinoma cells mingled with erythrocytes and leucocytes, the majority of carcinoma cells being necrotic. Russels and Cairns² have found that the development of that subdural false membrane is the result of permeation by growth of the veins and capillaries of the outer dense layers of the dura.

COMMENT

The clinical and pathological examination of the case evidenced particularly three findings which have to be discussed: (1) the carcinoma cells within the blood vessels of the nasal mucous membrane; (2) the occurrence of peculiar cells in the nasal glands; (3) the connection between the puncture of the maxillary sinus and the hemorrhage from the gastric carcinoma.

(1) The most outstanding feature was the finding of emboli within the veins and lymph vessels of the nasal mucous membrane consisting of cells with large nuclei and somewhat irregular margins of their protoplasm. Considering the formation of emboli and the occasional finding of mitosis within these cells, there could be no doubt that these cells did not belong to the normal content of the blood. The comparison between these cells and the cells of the carcinoma of the stomach (Fig. 6) revealed the identity of both kinds of cells indicating the cellular emboli within the blood vessels and lymphatics as emboli of carcinoma cells.

The finding of emboli of carcinoma cells within the blood vessels and lymphatics is very well known in cases in which, for instance, a primary carcinoma of the intestines invades a great blood vessel, and the carcinoma cells by entering the blood circulation appear within the blood vessels of the dura, the pleura, the peritoneum and the lungs. In our case the dura was involved. Since the

pleura and the peritoneum were not examined from that point of view, the existence of carcinoma cells within the blood vessels of these membranes cannot be excluded for sure. Within the dura a typical carcinomatosis was discovered invading the cavernous sinus and affecting the oculomotor nerve on that side. Since the pathological finding in the nasal mucous membrane was essentially identical with the finding in the dura, we feel justified in making the diagnosis of a "carcinomatosis of the nasal mucous membrane", which was found in the mucous membrane of the inferior and middle turbinate on the right side. Unfortunately, other parts of the mucous membrane were not examined.

The carcinomatosis of the nasal mucous membrane cannot be called an extraordinary occurrence since there is no reason to assume that in a case of circulating carcinoma cells within the blood such cells cannot form emboli within the blood vessels and lymphatics of the nasal mucous membrane as they do within the blood vessels of dura, pleura and peritoneum. Nevertheless, this assumption has not been proved as yet by microscopic examination as far as we can discover from the literature.

From the clinical point of view, the finding is very interesting since the carcinomatosis of the mucous membrane did not produce a tumor-like formation in our case. We can even say that probably as a rule it does not produce tumors, for if it did, the disease would unquestionably be at least known to the pathologist. In that way the carcinomatosis of the nasal mucous membrane differs from the carcinomatosis of the dura, the latter of which occasionally produces tumor-like formations, as it was observed in our case.

The absence of tumor-like formations in carcinomatosis of the nasal mucous membrane renders the clinical diagnosis difficult. As a matter of fact, we did not make the diagnosis. We did, however, make the diagnosis of a metastatic tumor or of multiple myeloma. The following indications led to that diagnosis: the cachectic appearance of the patient, the dense shadow of the right maxillary sinus and right ethmoid on the x-ray picture, the absence of bony resistance in performing the puncture of the maxillary sinus through the inferior meatus, and the profuse bleeding after the puncture, which all suggested definitely the existence of malignancy within the nose. The absence of tumor-like formations in the nose, of polyps and of spontaneous nose-bleeds did not fit into the diagnosis of a primary malignancy. Consequently, we were dealing either with a secondary or a multiple malignancy. We did not consider the possibility of a

carcinomatosis of the nasal mucous membrane since we did not recognize the existence of that disease.

In the mucous membrane of the maxillary sinus, as far as we could examine it, we did not find carcinoma cells, but we did find a severe chronic inflammation with loss of epithelium layer and mucopus within the lumen of the sinus. Since the mucous membrane of the maxillary sinus contains far less blood vessels and lymphatics than the mucous membrane of the nose, the absence of carcinoma cells was not surprising. The pathogenesis of the purulent sinusitis we cannot explain definitely, since we did not have an opportunity of making a thorough microscopic and macroscopic study of the lateral wall of the nose.

(2) In the year 1897 Schaffer found in the salivary glands as well as in the secretory ducts, cells which he characterizes as "granular, swollen." Many years later Hamperl¹³ studied these cells more thoroughly and has called them "onkocytes." He found these onkocytes in the salivary glands, pancreas, parathyroid gland, hypophysis, thyroid glands, Fallopian tubes and in some tumors originating from these organs. He describes these cells as follows: "The cell is enlarged and shows a peculiar granular quality, the individual granules being distinctly acidophil. We may consider these granules as proteins mixed with lipoids as indicated by the staining with sudan. If the granules are not stained or are diluted, a network appears in the cell being less acidophil." On account of that enlargement of the cells Hamperl has chosen the name "onkocytes." Less significant is the nucleus which often shows the same features as the nucleus of the cells typical for the affected organ. Frequently, the nucleus contains more chromatin and consequently is more intensively stained with hematoxylin. Occasionally it shows manifold impressions imitating a pyknotic condition. Furthermore, the change of the situation of the nucleus within the cell is noteworthy although that change is not always very definite. The nucleus often moves away from the basis of the cell and thus it is found in the center of the cell or even close to the surface of the cell.

It is obvious that this description fits thoroughly the cells found in the nasal glands of our case. We, therefore, must say that onkocytes appear in the nasal glands as well as in the organs examined by Hamperl. Whether or not that is a frequent occurrence is a question along with other questions which will have to be answered by further examination of nasal mucous membranes under varied conditions.

(3) In attempting to associate the hemorrhage from the carcinoma of the stomach with the puncture of the maxillary sinus, we may refer first to the collection of cases reported by Grove⁴ in 1922. In his large series, death followed antrum puncture in 74 cases, the etiological factor being described as an air embolus, cocaine poisoning or a nasal reflex irritation of the vagus nerve which caused some disturbance in respiration and circulation. The first two factors can be eliminated in our case since air embolus causes immediate death, which was not so with our patient, and cocaine was not used.

Killian,⁵ in referring to nasal reflexes, divided them into the anterior or ethmoid and the posterior or sphenoid types. He distinguished three degrees of reflex action: (1) local, confined to the nasal cavity itself; (2) regional, with involvement of other parts of the fifth nerve; and (3) widespread, which encroach on other nerves. The local and regional reflexes are demonstrated by the itching which not only is present in the nose where the irritation is present but also in the conjunctiva and in the lacrimal caruncle. Photophobia or even frontal sinus pain may be associated. The distant reflexes can be exemplified in the form of the nasal cough or sneeze.

Kratchmer,⁶ in experiments on rabbits, concluded that there is a peculiar reflex connection between the nasal mucous membrane and respiration and circulation. He found that it appeared with irritation of the mucous membrane, especially by gases causing expiratory cessation of respiration, closure of the glottis, slow heart action, and an increase in blood pressure. Sandman⁷ in 1890 carried out more minute experiments for a study of the bronchial muscles.

Gording⁸ was the first to experiment on the mucous membrane of the antrum mucosa. These experiments were carried out on healthy rabbits. Air alone was first injected into the normal antrum through a short cannula. A complete survey showed that following the air injection, respiratory disturbances occurred which ended in expiratory cessation in the majority of cases. The pulse and blood pressure were not much altered.

Further experiments were carried out with chemical stimuli, namely, alcohol, ether, and tincture of iodine, since they would exert a powerful irritative effect. These irritants caused not only the "most violent disturbances in respiration" but also tonic and clonic spasms in the muscles of the face and extremities, as well as a marked rise in blood pressure.

Gording explains the rise in blood pressure as a result of increased peripheral resistance which the heart can overcome for only a short time. He describes two possible anatomical explanations: (1) The trigeminal branches in the back of the nose pass through the sympathetic sphenopalatine ganglion and send out collaterals which envelop the sympathetic nerve cells in the ganglion. The latter again connects with the plexus of the sympathetic nerves around the carotid artery, so that a stimulus that is transmitted through the fifth nerve to the ganglion may produce a constrictor impulse to the sympathetic nerves around the internal carotid artery. This constriction of the blood vessels in the region of the carotid artery hardly seems sufficient to account for the great rise in blood pressure. (2) The second explanation is more likely to account for the increase in blood pressure: irritation of the alveolar nerves through the second branch of the fifth nerve to the semilunar ganglion and thence to the brain proper. From here the impulse is transmitted to the vasoconstrictors.

Since the preceding experiments, as well as the work of Holmgren and Langendorf, prove definitely the existence of a circulatory disturbance associated with irritation of the antrum and nasal mucous membrane either through the vagal effect on the heart or reflex vasoconstriction, we feel we can explain the gastric hemorrhage of our patient in the following manner: The antrum puncture and irrigation caused an irritation to the mucous membrane of the antrum, which reflexly caused some disturbance in circulation. This circulatory change forced too great a load on the blood vessels of the tumor in the stomach, which already probably were weakened by the tumor, and they ruptured causing the hemorrhage and subsequent death of the patient.

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THE PARTIAL SADDLE NOSE: A SIMPLIFIED
TECHNIQUE WITHOUT THE USE OF
IMPLANT OR TRANSPLANT

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PHILADELPHIA

It is the accepted procedure to correct all types of saddle deformities with either an implant or a transplant. This includes the small nasal defects of the dorsum, referred to by some as a "false¹ saddle nose" and by others as a "relative" saddle nose." These designations are ambiguous and fail to portray the existing condition. The term partial saddle nose, more accurately appears to describe these deformities: First, because one type presents a slight saddling due to a prominent tip or an exaggerated retrousse nose and is therefore only a partial saddle nose; second, when a hump and depression are both present, it still is only a partial saddle nose.

The etiology of the saddle nose and its various types² have been presented elsewhere together with a survey of the substances employed in the correction of such a deformity,⁴ the author's choice and the technique in detail.⁵

The purpose of this paper is not to evaluate the relative merits of the former procedures but to consider only the reconstruction of the partial saddle nose. For many years we have used elephant ivory for the repair of small defects. Others have done likewise.⁶ Rib cartilage⁷ has been employed to fill in this defect, while others prefer alar cartilage,⁸ septal cartilage⁹ and a host of other materials.¹⁰

About five years ago, a patient was referred for the correction of a partial saddle nose. Intranasal examination revealed that the insertion of an implant was not practical. In fact, the trauma producing the defect was of such severity that little remained to support an implant. In carefully chosen sentences, this intelligent patient insisted that the correction be accomplished without the use of any inserted material. Evidently he had made the rounds and was well informed regarding his deformity and the known methods of correction. Experimental investigation on the cadaver soon revealed that the partial saddle nose could be corrected without resorting to

an implant or transplant. And so, an exception, again revealed that many ideas originate outside the realm of our profession.

To describe the technique in detail, it seems appropriate to divide the partial saddle deformity into two distinct types.

Type I.—The excessively prominent tip and the exaggerated retrousse nose seen in this type are usually congenital in origin. These, formerly corrected with a large implant or transplant, are now restored to a more normal appearance by an anatomical featural correction. With the Joseph double-edged scalpel, the initial incision (Fig. 1) is made (intranasal) between the lateral and alar cartilages on both sides, over the dorsum and sides of the nose. This dermal separation embraces three-fourths of the lower portion. The incision is continued over the cartilaginous septum with a blunt bistoury to the anterior nasal spine. The dermal separation is now completed. The nose has been "opened" which is analogous to the term employed in general surgery of "opening the abdomen." The lateral cartilages are then separated from the cartilaginous septum and the overlapping portions are removed. That portion of the cartilaginous septum producing the prominent tip is removed with a very sharp scissors, preferably the type with removable blades, resulting in a straight profile (Fig. 2). If the nose requires shortening, it is accomplished by removing a triangular section from the septum (Fig. 3). The cartilaginous septum and columella are then brought together with two silk sutures. The alar cartilages are split close to the septal margin, dissected free, everted and sections removed on both sides to the desired proportions (Fig. 4). The remaining alar cartilages are pushed back into their original bed and require no sutures. This narrows the tip in proportion to the total amount of excised cartilage. And now for the final inspection, which is exceedingly important. All lines of incisions must approximate each other perfectly; the slightest overlapping should be trimmed. Careful attention to details will result in union by first intention and in a short space of time the intranasal incisions are not observed. The operation is completed by inserting a tiny piece of vaseline gauze into each nostril, which remains for 24 hours and is not replaced. The nasal orifices should not be distended or tightly packed after any nasal plastic correction except in rare instances. A gauze dressing is applied externally with strips of adhesive. Over this is placed a pliable padded metal splint which prevents hematoma, any undue swelling and hastens regeneration. The metal splint is removed in 24 hours and is not reapplied. Dressings are changed daily. Blood and mucous collections are best removed with swabs

of peroxide. In practically all corrections of this type, the two sutures may be removed on the third day, all dressings on the fourth and the patient discharged on the fifth.

Type II.—In this type, a hump and depression are both present in many variations; are nearly all traumatic in origin and are corrected without an implant or a transplant. The most common variety observed is the bony hump with a cartilaginous depression.

The nose is "opened" as in Type I, except that the dermal separation is continued up to the nasion and a little further down on the sides. With the Joseph periosteal elevator, the periosteum is removed from the dorsum and sides of the nasal bones. The bony hump is cut through with the right and left bayonet saws on a line above the cartilaginous depression (Fig. 5). This is predetermined by feeling the thickness of the structures about the tip. The cartilaginous portion of the hump is severed with the button-hole scalpel and the entire hump is removed in one piece (Fig. 6). Then with a rasp, the roughened nasal bones are made smooth. It is amazing how little of the hump must be removed in these cases. If in doubt, it is best to undercorrect, for one can always return later in the course of the operation and remove slightly more of the hump if necessary. Most cases require shortening, which is carried out in the same manner as described in Type I. However, in this type of shortening, the thicker structures about the tip which have been moved higher up on the nose, serves to fill in the cartilaginous depression. The nose is then sutured, columella to septum. Then after careful inspection, the operator must decide by sense of touch and experience the course to follow. The profile is made as straight as possible by reducing the bony hump further if necessary with either the heavy duty or fine rasps, as the case demands. It is axiomatic that when a hump is removed, the bridge of the nose must be narrowed. Failure to carry out this procedure (sometimes the case) produces an unnatural appearance. The incision is made with a double-edged scalpel just within the nasal vestibule at the inferior border of the ala, in the direction of the nasal process of the superior maxilla. A right angled periosteal elevator is introduced into this incision and the periosteum is not removed but lifted from the bone, thereby creating a tunnel for the right angled saw. The nasal process of the superior maxilla is sawed through on a line from its attachment with the frontal and corresponding to the greatest width of the bridge of the nose (Fig. 7). The same is repeated on the opposite side. By thumb pressure, the nasal bones are fractured mesially, producing a narrowed nasal bridge. If the above technique is carefully

observed in raising the integument and creating a tunnel for the saws, the tiny muscles of expression about the nose are not disturbed. Neglect of this important detail results in an expressionless nose, especially when the other features are utilized as in smiling. If the nostrils are out of proportion to the rest of the nose, they are reduced to the desired size by the method already described. The nose is repeatedly and gently inspected internally. Pieces of bone, cartilage, periosteum and coagulated blood are best removed with a fine rasp. It is sufficiently important to repeat that all incision lines must approximate each other perfectly and all minor adjustments carefully accomplished. The daily dressing previously described is applied, except that the Joseph brace is worn continuously for the first two or three days. On the fourth and fifth days the brace is applied for an hour or two following daily dressings. The two sutures are removed on the fifth day and all dressings on the sixth. From the seventh to about the tenth day, at which time the patient is discharged, the nose is cleansed with sterile swabs of peroxide. When all swelling has subsided, "after" photographs are taken, with a semi-annual follow-up.

It is evident that there exists numerous subdivisions of the two types herein described. By simply sketching the nasal deformity, the method of approach may be clearly decided preoperatively. The operator must have in mind the definite technical approach before operation, guided by the two main types and their variations.

Novocaine 1 per cent with adrenalin by infiltration is employed in all rhinoplasties. General anesthesia is not used since the incident nausea and vomiting invite infection. The shape and size of the nose should be reconstructed to harmonize with the other facial features and stature of the individual. All intranasal pathology or mechanical interference is corrected first.¹¹ After complete regeneration, the nasal deformity is corrected. We have seen numerous cases where a submucous resection and a complete rhinoplasty were done at one operation with disastrous results. It is not only reasonable but sound surgical judgment that too much surgery in any given area is unsafe. While it is inconceivable that rhinoplasties should be attempted by other than the intranasal route, yet, too often we encounter external incisions of all types which are referred to in the literature as almost invisible scars.

The minimum age requirement for nasal plastics is 17 years, by which time the structures have attained their maturity. Nor should a septal resection be accomplished before the age of 14, since one-third of these cases later result in a saddle nose.¹² If a younger

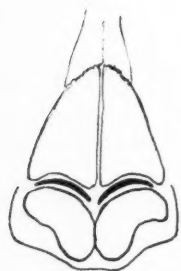


Fig. 1



Fig. 2

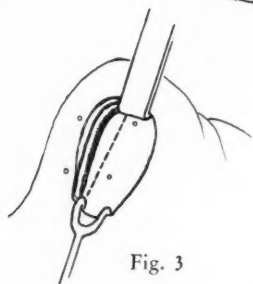


Fig. 3



Fig. 4



Fig. 5

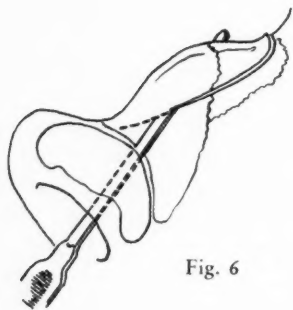


Fig. 6

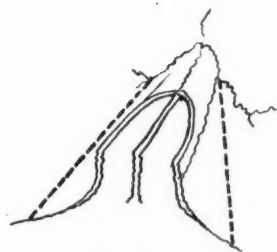


Fig. 7

Fig. 1. In lifting the tip with a small retractor, the inferior border of the triangular cartilage is readily seen. The initial intranasal incisions are indicated by the heavy curved lines between the alar and triangular cartilages.

Fig. 2. The dotted line represents the septal resection necessary to produce a straight profile. The hump is removed in one piece. In this area, particularly, a small regrowth sometimes occurs which is removed in the same manner.

Fig. 3. The degree of nasal shortening is in direct proportion to the amount of septal cartilage removed. The excision must extend down to the anterior nasal spine. The cyclets indicate where the two silk sutures are placed, approximating the septum and columella.

Fig. 4. The dark portions illustrate resection of the alar and lateral cartilages which reduces the size of the tip. These incisions must approximate each other perfectly to insure natural contour.

Fig. 5. Sketches like the above are made on the "before" photographs. Note how little of the hump necessitates removal, the level line being above the cartilaginous depression. Raising the tip will fill in this depression resulting in a corrected profile.

Fig. 6. Removal of the nasal hump must be precisely at the same level on both sides to prevent asymmetry.

Fig. 7. The nasal fracture must occur in the natural groove produced by the bony arch resting on the nasal process of the superior maxilla. This narrowing effects a relatively increased height to the bony arch.

child develops a nasal deformity as the result of an internal nasal obstruction and surgical intervention is imperative, conservatism¹³ must be the watchword.

Obviously there are borderline cases in the partial saddle deformities in which the surgeon must determine, after careful consideration, if an implant is to be used or if the more simple technique is to be employed. If the nasal bridge will appear sufficiently high (normal for that individual) after removing the hump and fracture, then the more simplified technique may be employed. An implant or a transplant can always be inserted subsequently, if necessary. This is the fascination of rhinoplastic surgery, the study of the patient, sketches from the "before" photographs and constructing a mental picture of the operation to effect the final result. A balanced impartiality is never the ideal in surgery. We must choose sides. The basic principles in surgery should be simplicity, and any nasal defect which can be corrected without inserted material presents a distinct advantage.

Syringing the nose with physiologic saline after the operation, the use of wet dressings or cold compresses are definitely contraindicated. Postoperative swelling is variable and is augmented when too much novocaine has been used. It is also more marked in those individuals with coarse skin and thick alar cartilages. The infra-red lamp applied twenty minutes daily after all dressings have been removed, hastens regeneration. The patient is given the control switch with instructions to have the affected part feel comfortably warm, not hot.

Those engaged in plastic surgery realize that honesty and candor are of paramount importance. In doubtful cases it should be explained that a normal nose is only a relative term and the approximate improvement one can safely accomplish should be made clear.

Rhinoplasties are accomplished for functional and cosmetic purposes and for the more poignant reason—the economic factor.¹⁴ Inferiority consciousness associated with nasal disfigurement are exceedingly common.¹⁵ These corrections capable of changing ones viewpoint of life, effecting genuine happiness, are of themselves justification for surgical intervention.

During the past five years, we have corrected by this method many cases in which heretofore there would have been employed an implant or a transplant.

Finally, a note of warning. These operations should not be attempted after witnessing a correction or two. Yet we are all familiar with such unfortunate incidents. In this branch of surgery particularly the patient anticipates not only an excellent result, but he becomes hypercritical and looks for microscopic flaws. Any operative procedure which looks easy to the observer is a compliment to the skill of the surgeon and not an invitation at imitation. Those interested in rhinoplasties should study the course properly and thoroughly before attempting this exacting specialty. Every result is the surgeon's trademark and the evaluation of each case is at the mercy of the patient, his family and friends, for discussion and critical appraisal.

WIDENER BUILDING.

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SULFATHIAZOL USED WITH CARTILAGE IMPLANTS
FOR REPAIR OF FACIAL DEFECTS*

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SAN FRANCISCO

The correction of facial defects has always been a major surgical problem. Improper handling of these may result in a greater deformity than the original. A man, because his face was lined and wrinkled, consulted a reputable physician some years ago, who corrected the defect temporarily by the subcutaneous injection of melted paraffin. This foreign material, however, became disseminated throughout the adjacent tissues, and the resulting puckering of the mouth and swellings of the forehead and cheeks are now beyond correction, even by surgical means.

For correction of bony defects of the face, it is now generally agreed that the best material is costal cartilage, whether fresh or refrigerated and whether from the same patient or another individual. Foreign substances such as silver, ivory and celluloid were, like paraffin, used in the past to correct bony defects, but none of these proved as satisfactory as cartilage, for even when infection was avoided, the foreign material was sooner or later apt to be extruded. Bone was found to be a better transplant material than foreign substances such as the metals, but was more likely to be resorbed than cartilage. Osteoperiosteal grafts from the ilium or tibia are used to repair large bone defects, as in cases of loss of the mandible, in which a rigid protective and functional substance is desired. Costal cartilage is an excellent transplant material, for, besides being obtained readily, it can be cut to any required shape and will hold this shape without being so rigid as bone. In large defects, several pieces of costal cartilage may be sewn together.

In some cases cartilage is absorbed even in the absence of infection. This occurs much less frequently than does absorption of transplants of fat and is more likely to take place when several small pieces of cartilage are used. The principal disadvantage, however, in

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using cartilage is the danger of its destruction or absorption as a result of secondary infection, a danger present in the use of any transplant material except celluloid, ivory, glass and the metals.

Since these infections are usually caused by contamination from the skin and are often of staphylococcic origin, it was decided to use locally in the wounds some of the sulfonamide compounds for their bacteriostatic effect, in order to insure primary healing. The results have been gratifying, for with sulfamethylthiazol or sulfathiazol powder introduced into the wound with the cartilage implant, no infection has occurred. It seems that now the chances of broken-down hematomas and of secondary infections with complete absorption of the cartilage may be considerably lessened.

CASE REPORTS

CASE 1.—This patient had had a radical operation on the frontal sinus a year before. This resulted in a depression in the left supra-orbital region, which prevented his obtaining work. To fill this depression, three pieces of cartilage, taken some months earlier from two other patients and kept in tincture of merthiolate in the icebox, were sewn together with catgut and inserted subcutaneously. (As a prophylactic measure to prevent infection, which is usually of staphylococcic origin) $7\frac{1}{2}$ grains of sulfamethylthiazol powder was put into the wound with the cartilage. As an added precaution this preparation was given orally, 45 grains daily, for a week. Healing was by primary union.

CASE 2.—A man, aged 30 years, with a supraorbital tumor, said this had been present all his life. It proved to be a cystic lipoma, 4 x 3 x 3 cm. After it was removed, with the parts under local anesthesia, a marked depression, due to erosion or failure of development of the frontal bone, remained in the temporal fossa and above the supraorbital ridge. Several pieces of human costal cartilage which had been removed some months previously from two other patients were immediately inserted into the defect left by the tumor and sutured to the subcutaneous tissues, and 10 grains of sulfamethylthiazol powder was poured into the wound. The patient was also given orally 45 to $67\frac{1}{2}$ grains of sulfamethylthiazol daily for ten days.

CASE 3.—A girl, aged 19 years, came for consultation on August 1, 1939. Her nose had been broken at the age of nine

months, and she could not recall ever having been able to breathe through it. It was quite retroussé. The wide, flattened bridge deviated to the left of the midline, and the tip was without support. A submucous resection of the deformed septum, performed on August 3, gave good breathing space, and a section of flat septal cartilage from another patient, a man, was inserted between the mucous membrane flaps to give support to the new septum. The nasal processes of the maxillae were refractured so that the bridge could be narrowed and moved to the midline. Six weeks later, sections of costal cartilage removed some months previously from another patient were implanted beneath the bridge and columella, with correction of the external deformity; but the skin at the shortened tip was under so much tension that some sloughing of the skin occurred, and in addition the cartilage implants became infected and absorbed, leaving the same deformity as before. This was before sulfathiazol or sulfamethylthiazol was obtainable.

The operation was repeated when these compounds became available, and on March 11, 1940, a piece of costal cartilage was implanted to correct the defect in the bridge of the nose. Sulfamethylthiazol powder, 7 grains, was implanted with this piece of cartilage, and the same drug was given orally, 45 grains daily, from March 8 to 11, when the dosage was increased to 67½ grains daily and given until March 15. No infection occurred, owing, the writer believes, to the bacteriostatic action of sulfamethylthiazol.

A few weeks later, costal cartilage was implanted in the columella, and the powder was again used in the wound and orally as before. Although there was insufficient skin to cover the last implant, which remained exposed for several weeks, no infection occurred. It seemed remarkable that the powder kept the wound clean and free from discharge and the cartilage intact.

CASE 4.—A girl, aged 20 years, came in June 20, 1939, for correction of an obstructed and combination hump, saddleback and flat nose, the result of a fracture some years before. The obstruction was corrected by a submucous resection of the septum, and later the bony and cartilaginous hump of the bridge was freed with a saw and placed in the saddleback defect of the cartilaginous bridge, with a good initial result. Soon after, however, it broke down and formed a fluctuating mass. This was removed, and at the same operation two pieces of icebox-preserved costal cartilage removed some weeks before from another female patient were implanted beneath the

skin of the nasal bridge, while a third piece, one inch long, was implanted into the columella to give support to the tip. A little powdered sulfathiazol (5 grains) was now available, and was inserted in the wound with the cartilage and a pressure dressing applied. Sulfapyridine was given orally until April 29, when we were able to obtain a little more sulfathiazol. The latter was given in doses of 63 grains daily for four or five days. Then, since there was no evidence of absorption or infection, this was discontinued.

SUMMARY

There seems to be a definite indication for and real value in the local use of the sulfonamide compounds in facial plastic surgery, where asepsis is so important.

1801 BUSH STREET.

OSTEOMYELITIS OF THE FRONTAL BONE WITH
REPORT OF THIRTEEN CASES

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BOISE

The purpose of this article is not to give a detailed report of the histology or pathology of osteomyelitis of the frontal bone. This has been done exceedingly well by Furstenberg¹ and Mosher.² I hope to be able to give some information concerning the necessity of early diagnosis of osteomyelitis and the correct procedure to follow after the diagnosis has been made. There seems to be a lack of knowledge in the mind of quite a few clinicians as to when an individual has osteomyelitis.

Quoting briefly from a report in one of the large State Journals:

"Child, aged 11, was brought to the hospital complaining of headache localizing over the left eye. There was present a gradual swelling over the left eye and forehead. There was a history of an acute cold three weeks before.

"On August 10, under general anesthetic the anterior end of the left middle turbinate was removed and the agger nasi and a few ethmoid cells were opened. An intranasal opening was made into the left antrum. Following this the sinuses were irrigated and the nose was shrunk daily. Two days later it was noted that the patient was drowsy and sleepy. On August 18, the patient was operated upon again. A submucous resection was done. August 20, the drowsiness had disappeared. On August 22, the left elbow joint became swollen and painful. On August 29, there was a soft, doughy tumor at about the location of the anterior fontanelle which was tender on pressure.

"On September 12, the report states that 'the general condition was satisfactory although the fluctuating mass on the head was increasing in size.' This swelling was opened, no pus was found on incision. On September 21, the patient was allowed to leave the hospital. On September 25, the patient was readmitted to the hospital because of an increase in the size of the swelling on the forehead

and vomiting, and on the same day an x-ray diagnosis was made of osteomyelitis of the frontal bone.

"On September 27, the case was operated on again, a longitudinal incision made over the swelling and all necrosed tissue and bone removed and the wound closed.

"On October 5 the patient vomited again. The wound was healing nicely.

"On January 12, three months after her first illness, the patient died. The necropsy revealed a left frontal lobe abscess."

A second report from another Journal:

"Child admitted September 8, in a stuporous state with swelling over the eyes extending into the forehead. On September 10, an intranasal operation was done and pus was found in the antrum and ethmoids. The patient felt so well that it was discharged from the hospital on the 20th of September, but there was still swelling over the frontal bone.

"The patient was readmitted to the hospital on September 23rd, following a convulsion and died on November 10th with a generalized meningitis."

Several of the cases I am reporting show a general lack of knowledge of osteomyelitis.

A boy, first seen by me on September 26, 1934; mother stated that they consulted the family doctor six weeks before for a swelling around the eyes and over the left side of the forehead. An abscess had localized beneath the left eye which was opened by the family doctor and pus had been discharged from this opening for the past four weeks. Pressure over the forehead caused pus to be discharged from the opening beneath the eye. After pressing out considerable of the pus, a definite break could be felt in the frontal bone, and at the time of the operation the following day, about two-thirds of the frontal bone was necrosed. Both the anterior and posterior plates were gone and there was a large epidural abscess; the dura was covered with thick granulation tissue.

Mr. W., aged 51, came to see me April 14. He stated that during the previous September he had had the right antrum washed every day for a period of ten days. Following this he developed severe pain and swelling over the center of the forehead. The pain lasted until there seemed to be some sudden expansion over the fore-

head and the swelling was soft to touch. Pressure over the swelling caused pus and blood to be discharged from the left nostril. The antrum was irrigated occasionally but no attention was paid to the swelling over the forehead.

X-rays showed a definite osteomyelitis involving a large area of the frontal bone.

Three of these cases had been cared for by men practicing ear, nose and throat. Certainly when we find cases of this type, more information concerning the early diagnosis of osteomyelitis of the frontal bone is necessary.

I do not think that we can have any definite procedure to follow in our operative care of these patients. It is not necessary to block off and remove a whole area of the frontal bone because the diploic spaces are tortuous. The osteomyelitis tends to follow along the area of the diploic spaces and the operative procedure that I have been following has been along this line. It is quite necessary to make your incision sufficiently large so that you are able to uncover a large amount of bone for inspection, and the bone removal should extend laterally far enough to reach the outer limit of the frontal sinuses.

In my paper "Osteomyelitis of the Frontal Bone,"¹ I reported making the incision from eyebrow to eyebrow and splitting up the middle of the forehead, leaving the flaps open and the dressings after the operation were done between the open flaps. This left a very disfiguring scar. I have found that I have been able to secure the same end results by more conservative incisions. I have followed the hairline incision as brought out by Furstenberg^{1-a} with almost no visible scarring, and I have also followed the incision from eyebrow to eyebrow, being careful to preserve the periosteum. With plenty of assistance in elevating the scalp, an excellent view can be obtained of the questionable area. This also leaves very little scarring. The end results in this group of cases, I think allows me to state: that the enormous disfiguration caused by keeping the flaps separated during the healing is not necessary.

I shall briefly report seven cases of osteomyelitis of the frontal bone without intracranial involvement and four with intracranial involvement. Four of these have been reported elsewhere² and I will quote again from that article, in order to round out the entire group.



Fig. 1. Resulting scar after flaps were pinned back for four weeks.



Fig. 2. Resulting scar after sutures were placed through the flaps and dsewed down at the end of four days.



Fig. 3. Resulting scar where wound was completely sutured and a large intranasal drain placed through nose into right frontal sinus.



Fig. 4. Absence of scar following hair line incision and side drains.

CASE 1.—Child, female, aged 13, consulted me November 30, 1928. She came in with a large swelling over the frontal area which had been incised by the family physician two weeks previously. This swelling had followed an acute head cold. A large amount of pus had been drained from the incision ever since it was opened. X-rays showed a generalized osteomyelitis of the frontal bone. An incision extending from eyebrow to eyebrow joined by a central incision through the middle of the forehead disclosed a dark necrotic bone over most of the forehead. The dura was uncovered and both frontal sinuses were filled with pus.

Operation: The operation consisted of removing all diseased bone, also removing the anterior wall of the frontal sinus down to the supraorbital ridge and to the extreme limit of the lateral prolongation of the frontal sinus; an exenteration of the anterior and posterior ethmoids; enlarging the nasofrontal duct and inserting a Penrose drain. The skin wounds were sutured together. The patient made an uneventful recovery but had considerable scarring.

CASE 2.—College student was taken ill with the flu January 20, 1935. He remained in the university hospital until February 6. He had had severe pain over the left frontal bone and there had been some slight swelling just above the eye; however, there was no pitting on pressure or edema.

On February 7, the x-rays showed a clouding of the left ethmoids and slight clouding of the left frontal. Under local anesthetic, the anterior tip of the middle turbinate was removed; the anterior ethmoids opened and the left frontal sinus irrigated. The pain and swelling subsided.

On February 11, he began to have some pain over the right eye. The x-rays showed involvement of the right ethmoid and a slight clouding of the right frontal. The anterior tip of the right middle turbinate was removed as well as the anterior ethmoid cells. A large amount of pus was irrigated from the right frontal sinus. The pain and swelling over both eyes subsided and the boy was allowed to go home.

On March 1st, two weeks later, he began to have pain over the entire forehead and, when he returned, there was swelling and edema over the forehead. X-rays showed cloudiness of both frontals, but osteomyelitis was not demonstrated. The temperature was 100.6 degrees. The interior of the nose was boggy and there was pus in both nostrils. That same day an incision was made from

one eyebrow to the other and a joining central incision down through the forehead. The periosteum was reflected back and there was a discharging fistula through both frontal plates. The anterior wall of both sinuses was removed and osteomyelitis was found to have extended up to within a half an inch of the hairline. The posterior plate was also eroded. The dura was exposed and an epidural abscess was found; there was a grayish exudate over the dura. The dura was painted with 5 per cent iodine.

The ethmoids were curetted and a Penrose drain inserted into the frontal sinus through both nasofrontal ducts. Silkworm sutures were retained through the flaps, but were not tied. Daily inspection for five days of this area showed no further involvement. The flaps were carefully approximated and the sutures tied. The boy made an uneventful recovery. X-rays had shown a complete regeneration of the frontal bone and he has been an outstanding guard on the university football team for the past two years.

CASE 3.—Mr. W. P., aged 49, consulted me June 9, 1930. Following swimming ten days previously, he had developed an acute pain over the left side of the face, and had been treated elsewhere with intranasal packings with very little relief. Two days before coming to my office the left eye became swollen shut and the swelling extended up to his hairline. A large amount of pus was seen in the nose; the temperature was 101 degrees; there was a choked disc of about two diopters in the left eye. The patient was drowsy and very ill. X-ray showed left-sided pansinusitis and questionable osteomyelitis.

Operation: A curvilinear incision extending from the margin of the left eyebrow down over the bridge of the nose and up into the center of the forehead was made. The frontal bone was dark and moth-eaten and several small sinuses were discharging pus. The entire left frontal bone was removed out to the extreme outer angle of the frontal sinuses; the partition between the right and left frontal sinus was eroded and this was completely removed. The upper part of the septum was removed. The ethmoids were extirpated. There was no evidence of involvement of the posterior plate of the frontal sinus. A Penrose drain was inserted and the wound closed. The choked disc disappeared in a few days and the patient made an uneventful recovery. The culture showed a mixed infection.

CASE 4.—Mr. E. M., aged 47, came to the office October 23, 1937, complaining of pain and swelling and edema over the right eye for the previous two weeks, with a marked postnasal discharge for many years. He had had an intranasal operation in 1920 and had had pain and swelling before this operation. In 1928 he had another intranasal operation with some relief from pain.

The x-rays showed a definite osteomyelitis of the right frontal bone. A large amount of pus could be washed out of the right frontal sinus. The patient refused operation at this time. He consented, however, three weeks later.

Operation: On November 15, under local anesthetic, a curvilinear incision was made over the right eyebrow and down on the nose, also a central incision extending up to the hairline. There was a large perforation of the frontal sinus just above the inner angle of the right eyebrow. The bone was black and necrosed for about a half inch around the opening. The partition between the right and left frontal sinus was eroded, but the elevation of the periosteum showed no evidence of involvement of the left frontal bone. The entire anterior wall from a very large right frontal sinus was completely removed nearly to the hairline where normal bone was encountered. There was no evidence of osteomyelitis of the posterior plate of the frontal bone. The anterior and posterior ethmoidal vessels were severed with electric cautery and the ethmoids were exenterated. Both a Penrose and a hard rubber drain were placed in the frontal sinus and the external wound sutured.

After the removal of the drains, a No. 17 urethral sound was passed into the frontal sinus every day for a period of six weeks. At the present time his right frontal sinus can be very easily irrigated with a large cannula. The patient has had no further trouble and no pus had been aspirated from the frontal sinus for the past year and a half. There was very little external scarring.

CASE 5.—Mr. J. W. came to the office in September, 1935. There was an external fistula just above the inner canthus on the left side. There was also a marked swelling of the entire left forehead which was very edematous and painful. The patient stated that a general surgeon had made an external opening in the frontal sinus eight years previously and that every time he had a slight cold since the previous operation, there had been a discharge of pus from the external opening just above the left inner canthus with pain over that side of his head.

This time the swelling had not subsided following his cold and the swelling of the left side of his head had increased and the pain was very severe whenever the external opening became closed. X-rays showed a cloudy left frontal.

Operation: A curvilinear incision was made over the left side of the nose and left eyebrow, joined by a central incision down his forehead. The periosteum was elevated over the left frontal sinus; the old fistulous tract was probed and dark colored bone was found above the fistulous tract extending up into the frontal bone. There was pus in the bone for about an inch above the old fistula; the removal of bone was continued upward laterally until normal bone was encountered.

A plastic operation consisting of removing the scar tissue from around the old fistulous tract was done at the same time. The ethmoids were exenterated. A Penrose drain inserted into the frontal duct. The plastic repair of the old fistulous opening was successful and the patient has had no further trouble in the past three years.

CASE 6.—Mr. H. B., aged 42, came in because of pain and swelling over the right frontal bone on June 24, 1939. One and one-half years ago he had a tooth pulled and developed an infection of the left antrum. He had had a profuse nasal discharge from the left side. The right eye was proptosed and almost closed and there was swelling for about two inches above the right eye extending over the forehead which was very edematous and tender on pressure. There was considerable pus in both nostrils. Temperature 99.6 degrees. X-rays showed cloudy left antrum and cloudy right frontal. The left frontal did not show much clouding.

Operation: Curvilinear incision over the right frontal sinus; a large amount of pus was discharged as soon as the periosteum was incised. The incision was extended across the midline to the left eyebrow and the periosteum carefully elevated. There was a large hole through the right frontal sinus about a half an inch above the orbital rim. Surrounding this hole was black necrosed bone which extended up for about two inches. The partition between the right and left frontal sinus was eroded, and the left frontal sinus was filled with thick pus. For some reason this did not show in the x-rays. There was no evidence of involvement of the posterior plate of the frontal sinus and the bone was removed past the midline to the left frontal sinus until normal bone was encountered. The bone was also removed for a large area over the right frontal sinus. The anterior

and posterior ethmoidal vessels were ligated and complete exenteration of the right ethmoids was done. The upper portion of the septum was entirely removed and a large opening was made beneath the turbinate into the left antrum. A Penrose drain was inserted and the external wound sutured.

The left antrum has been aspirated a number of times and has had no pus in it since four weeks after the operation. A recent photograph shows the lack of external scarring.

CASE 7.—Mr. R. B., aged 47, first came to the office January 30, 1939, because of swelling and tenderness over the left eye. He said he had had sinus trouble for many years. Temperature 99.4 degrees. A large amount of pus was seen in the nose. I was absent from the office at that time. The x-rays showed definite evidence of osteomyelitis of the frontal bone. There was edema and swelling over the right eye and the right eye was pushed out and down.

He left, stating that he would be back for operation in a day or so. He did not return until the 7th of April. He stated that he had worked every day in the meantime but that he had a daily headache and felt as though he had some temperature. X-rays showed definite breaking down of the frontal bone. The temperature was 99.6 degrees.

Operation: Under local anesthesia an incision was made running from the outer edge of the right eyebrow to the outer edge of the left. The periosteum was carefully elevated. A large area of the frontal bone was necrosed and broken down. The posterior plate of both frontal sinuses was necrosed. A large area of the dura was exposed and this was covered by a thickened brownish exudate. This exudate was not disturbed, but the entire area of the dura exposed was painted with 5 per cent iodine.

The upper part of the septum was entirely removed, the ethmoids were exenterated on both sides and were filled with polyps and pus. A Penrose drain was inserted on each side and the external wound sutured. The patient has been working every day since the first of June in a near-by sawmill.

INTRACRANIAL COMPLICATIONS

I have had two cases of osteomyelitis of the frontal bone following injury and not connected with a sinus infection.

CASE 1.—Baby F., 2½ years old, came to my office June 18, 1937, with the history that he had been struck on the head with

the hub cap of a tricycle nine weeks previously, and that since that time, pus and small spicules of bone had been discharging from a fistulous opening in the center of the forehead. The baby was not ill; had no temperature. I was absent from the office and for some reason little attention was paid to the case.

He returned to the office again on the 3rd of September, nearly five months after the original injury. There was still a small fistulous opening in the center of the forehead. The baby was not ill. Digital examination showed an area about an inch in diameter where there was an absence of bone. X-rays showed some osteomyelitis around the border of the diseased bone.

Operation: Under general anesthetic, I made a curvilinear incision extending from the right temporal area just under the hair-line over the left temporal area. The scalp was turned down and an opening about an inch in diameter was found through the frontal bone. The dura was covered with granulation tissue and there was considerable hair and debris crushed into the dura as well as a few fragments of infected bone. These were carefully removed and no break was seen through the dura. The bone was removed from around the original opening for an area of about two inches in diameter until I had extended into the normal bone for about a half an inch. The dura was painted with iodine. The fistulous opening through the scalp was freshened and sutured together and the entire flaps sutured back in place without a drain.

The child was allowed to go home on the fifth day, and was seen from time to time for the next month. He was also seen in the office again on November 8th. The child had been quite well. There was still a large soft area that could be felt through the center of the frontal bone.

The child was not seen again until January 11th. It was brought into the office and appeared ill. The mother said that she thought it had had the flu for the past week. The temperature was 101 degrees and there was a bulging in the center of the forehead with about four diopters of choking in both discs. The child seemed quite ill and was drowsy, and there was some rigidity of the neck. The child was taken immediately to the hospital. A diagnosis was made of right frontal lobe abscess.

The dura was uncovered; there was definite bulging. An attempt was made to insert a trocar into the abscess. Marked resistance was encountered and when the abscess wall was finally pene-

trated, about an ounce of thick pus was discharged. The child died suddenly eight hours later.

Postmortem: Upon removing the calvarium, the vessels of the dura and meninges were distended with blood. The superior sagittal sinus contained a thrombus 4 cm. in length. The rubber drain extended into the right frontal lobe of the brain. There was a bulging of the frontal lobe into the right lateral ventricle and some fibrin and a small amount of yellowish-green fluid. Upon opening the frontal lobe an abscess $4\frac{1}{2}$ cm. in diameter was found filled with thick green pus. This abscess was lined with a thick membrane. The drainage tube passed along the side of the abscess and had not passed through the membrane lining it. Streptococcus and staphylococcus were found in the pus.

CASE 2.—Mrs. L. M., aged 56. I saw the patient in the hospital in consultation. The day before coming to the hospital she had a complete left-sided paralysis—left side of the face and left arm—was unable to recognize her friends and could not answer questions coherently. She had a scar in the center of her forehead that had a small scab on it. The family stated that three years ago she had bumped her head and that since that time some spicules of bone and some pus had been discharged from the opening and she had had very severe headaches ever since.

X-rays showed what appeared to be an area of osteomyelitis in the center of her forehead. A curvilinear hairline incision was made, the scalp turned down over the area. There was some evidence of osteomyelitis around the edge of a very thickened area of bone. The bone in the center of the area was nearly a half an inch thick and the dura was firmly adherent along the area of the center of the thickened bone. The dura was torn in an attempt to free it from the bone and cerebrospinal fluid escaped. The dura was sutured together again and the whole area painted with 5 per cent iodine. The slit periosteum was sewed together over the injured dura and the scalp was sutured back in place.

Her mentality was greatly improved the following day; she appeared normal on the third day and the paralysis cleared up in about six weeks' time. The headaches which had been persistent for several years have subsided.

CASE 3.—Mr. G. M., boy, aged 19, following swimming had had severe pain over the left eye for the past two weeks. Intranasal medication had been used with very little relief from pain. Three

days before consulting me, the left eye became swollen and proptosed. This swelling had gradually extended up over the left side of the forehead. The eyelid was opened with great difficulty; there was choking of the left nerve head of about two diopters. The temperature was 101 degrees. He was sent to the hospital for x-rays which showed a marked frontal sinus infection on the left side.

Operation: A curvilinear incision was made through the left eyebrow and down over the nose, and a central incision was made extending up through the middle of the forehead. Pus under pressure was found in behind the orbit and it was filled with gas bubbles and sprayed out for a considerable area over the operating dressings.

In a personal communication with Dr. F. G. Novy,³ bacteriologist of the University of Michigan, concerning the apparent explosions of pus, he answers as follows:

"This I would say is due to the fact that your organism is growing and producing carbonic acid, which, unable to diffuse or pass out into the surrounding tissue, is confined, and hence gives rise to positive pressure. The more anaerobic the condition under which it is growing, the more likely would the pressure be positive. If it were growing under aerobic conditions, the pressure would be negative." Personally I think that this formation of gas produced in this way might have something to do with the rapid destruction of bone in some of these cases of osteomyelitis.

All of the necrotic bone was removed but the inner plate did not seem to be involved. The swelling in the eye subsided, but five days later the pulse dropped to 40; the boy was drowsy; the spinal fluid count was 1500. The culture was negative. He had a positive Kernig and stiff neck. I called in Dr. J. L. Stewart in consultation and it was decided that the boy had some increase in intracranial pressure. He did a subtemporal decompression. No pus was found extradural. An incision was made through the dura, where it was adherent to the bone. Cerebrospinal fluid escaped under pressure. It was clear at first and later flocculent. In a few minutes the pulse increased in rate and became more regular. Later microscopic examination of the fluid showed much mucoid material with a few disintegrated pus cells. The culture showed no growth. Exploratory puncture did not reveal any walled off abscess. A drain was inserted and the skin wound sutured.

The boy made a slow recovery.

CASE 4.—L. S., female, aged 11, seen first in St. Luke's Hospital in consultation, June 24, 1929, 4 p. m., giving the history that three days previously she had gone swimming in the morning. That evening there was pain over the right eye. The next day it was much more severe; the family doctor was called in. Sunday the pain was more severe and she had a temperature of 102 degrees. The next morning the temperature was 104 degrees and pulse 120. There was some twitching of the left arm and leg. She was sent to the hospital and developed a convulsion which morphine did not control and was controlled only by the administration of ether. The spinal fluid count was 31. The culture was negative.

When I saw her there was marked swelling of both eyelids; the right eye was closed. The child was unconscious and there was marked twitching of the left arm and leg. X-rays showed clouding of the frontal, more marked on the right side.

Operation: At 4:40 that afternoon I made an external frontal incision, and after the frontal sinus was uncovered, a large amount of pus was seen escaping through a hole in the frontal bone under pressure. There was considerable osteomyelitis and softened bone for about an inch over the right frontal sinus. The posterior plate of the frontal sinus did not appear to be involved. The ethmoids were filled with pus. These were exenterated. The nasofrontal duct was enlarged. A rubber catheter was placed in the nasofrontal duct and the external wound sutured. Culture unidentified diplococcus.

On the 25th there was twitching of both arms, more marked on the left. A large amount of pus drained from the frontal sinus. The temperature had dropped to 102.6 degrees on the 25th. The patient was still irrational. On the 26th the temperature was 103 degrees. The patient was more rational and there was not very much drainage from the tube. The left arm was spastic and she was unable to grip with the left hand. She complained of severe pain to the left and center of the pubic bone and severe pain in the neck with some rigidity.

On the 27th the temperature dropped to 101.2 degrees; the swelling had receded from the eye. She complained of pain in the back of the neck and in the pubic region; she was irrational. On the 28th, the neck was quite rigid, not so much pain in the pubic region; left hand quite spastic; unable to flex fingers. Examination of nerve head negative.

On the 29th, Dr. J. L. Stewart was called in consultation. At that time the temperature was 101 degrees, pulse ran from 140 to

160. We made a preoperative diagnosis of leptomeningitis involving the motor area.

Under general anesthetic, he made a Wolfer type of flap; a trephine over the parietofrontal region was made exposing the anterior portion of the motor area and the dura under the posterior portion of the frontal lobe. A horseshoe flap was made in the dura one and one-half inches in diameter. An unsuccessful search was made for a possible subcortical abscess. An exploration with spatula and needle of the anterior portion of the frontal lobe evacuated a large amount of bloody cerebrospinal fluid. The intracranial tension seemed to decrease after the escape of the bloody cerebrospinal fluid.

The dural flap was closed with chromic No. 0, the fascia with chromic No. 0, and the skin closure was done with silk worm gut. One dental dam drain was placed in the subdural flap.

Cultures of the fluid from the brain were negative. The following day the temperature had dropped to 100.4 degrees. There was less spasticity.

On July 3rd all the drains were removed; the patient was entirely rational and she had regained most of the use of her left arm. The temperature continued to drop and on July 7th it was normal. The movement of the left side was returning. She had no pain. She was kept in the hospital until the 21st of July. She had a slight weakness of the left side for about a year, but at the present time there is no difference between the right and the left side and she is a robust woman of 21.

CONCLUSIONS

1. Swelling, edema and pain over the frontal sinus are of more value than an x-ray. The osteomyelitis precedes the x-ray evidence from about seven to ten days.

2. It is not necessary to cure the osteomyelitis by pinning the flaps back and dressing the wound with the flaps pinned back over a prolonged period of time. The same results can be accomplished by more conservative incisions.

3. I have found from a rather incomplete survey of the literature and personal observation in the cases I have reported that generalized osteomyelitis is often inexcusably overlooked.

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SELECTION OF TREATMENT FOR CANCER
OF THE LARYNX*

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In selecting the treatment for an individual case of cancer of the larynx, radiation and surgery, the two accepted methods, are often considered only from their competitive standpoints. In other words, one or the other is advanced by its proponents as offering a complete solution to the problem of laryngeal cancer, and it is inferred that by earlier treatment or improvements in technic, one particular method (either surgical or radiologic) may eventually become so efficient that the other can be discarded entirely. It is the purpose of this paper to point out the futility of such a partisan concept, to discuss the unique merits and limitations of both methods, to show that each is indicated in a particular form of laryngeal cancer, and that in some cases a combination of the two is superior to either used alone.

The treatment of laryngeal cancer by any method is accompanied by definite hazards and is unjustified in the absence of histologic proof of the presence of cancer. In every case, therefore, a biopsy is a prerequisite to the selection of a treatment method.

This discussion will be based upon the premises that (1) cancer of the intrinsic larynx is mainly a surgical problem and usually unsuited to radiation therapy and that (2) cancer of the extrinsic larynx is mainly a radiation problem, practically all cases being inoperable at the time of the first examination. Since on this basis the selection of the treatment method depends upon the anatomic form of the disease, it is necessary to define clearly an anatomic classification of laryngeal cancer.

ANATOMIC CLASSIFICATION

Standard anatomy texts, although differentiating between the extrinsic larynx and the intrinsic, do not define the limits of the two.

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The average surgeon describes intrinsic cancer vaguely as that which arises "within the lumen of the larynx" and extrinsic cancer as that which originates in the "walls outside the larynx." Radiologists are even more vague and are prone to include all extrinsic cancer under the broad term "cancer of the hypopharynx" as distinguished from that of the mesopharynx and of the epipharynx.

This question would be settled if agreement could be reached on a definite line of demarcation between the two. The vocal cords, obviously the main structures of the intrinsic larynx, are the most frequent site of intrinsic cancer. The epiglottis and its appendages, which constitute the main structures of the extrinsic larynx, are similarly the most frequent site of extrinsic cancer. In between these two parts of the larynx lie the ventricular bands, the free edges of which are seldom the original site of a growth. For practical and anatomic reasons, then, it seems most logical to separate the extrinsic larynx from the intrinsic at the free borders of the ventricular bands. Under such a division, all growths arising in the upper surface of the ventricular bands or above constitute cancer of the extrinsic larynx; all growths arising on the vocal cords, in the ventricles, or in the subglottic region are classified as cancer of the intrinsic larynx (Fig. 1).

The point of origin of any growth, rather than its later extension, should determine its anatomic classification; that is, if the lesion begins on a vocal cord, it should subsequently be classified as cancer of the intrinsic larynx, even though it may later extend upward to invade the structures of the extrinsic larynx or perforate the cartilage to invade the subcutaneous tissues. If one accepts this basis of classification, the term "mixed intrinsic and extrinsic laryngeal cancer" is superfluous, and "subglottic cancer" would be considered a subgroup of the intrinsic variety.

It has been repeatedly stated in the literature that the intrinsic larynx is the site of origin of 65 to 75 per cent of all laryngeal cancer. In the clinic at the Memorial Hospital these proportions are almost directly reversed; that is, cancer of the extrinsic larynx is about three times as frequent as cancer of the intrinsic larynx (Fig. 2). Part of this discrepancy may result from differences in classification. The greater part, however, is probably explained by the fact that patients with chronic hoarseness—always the first symptom of intrinsic cancer—would be referred to laryngologists, while patients with extrinsic cancer, complaining chiefly of pain or difficulty in swallowing or of enlarged cervical nodes, would have less reason

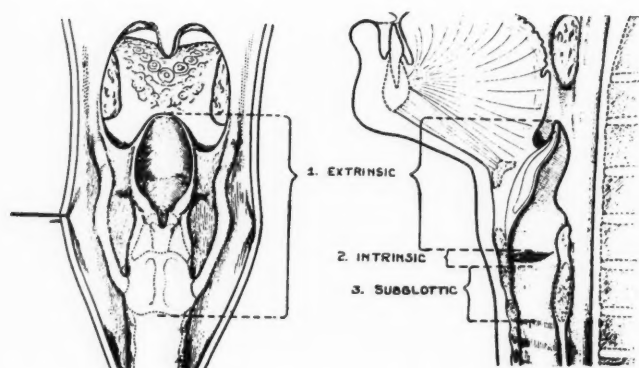


Fig. 1. Anatomic classification of laryngeal cancer.

to consult a laryngologist. I have discussed this subject with several laryngologists who are interested in the surgical treatment of laryngeal cancer, and most of them have told me that in their practices they seldom see extrinsic laryngeal growths. It must be admitted that the make-up of the laryngeal group in a cancer clinic may be modified by the fact that many early operable intrinsic cases would be retained in nose and throat hospitals for operations, while the extrinsic cases might be sent on to cancer clinics for radiation therapy. In a cancer clinic, however, where all forms of growths are accepted indiscriminately and followed to their termination, the anatomic distribution of these tumors probably more nearly approximates the true incidence in the general population.

At the beginning of this discussion it was stated that intrinsic laryngeal cancer is a surgical problem and that extrinsic cancer is a radiologic problem. These statements require further explanation.

Cancer of the intrinsic larynx or vocal cords is, for the most part, well differentiated squamous carcinoma Grades I or II, which at this site usually grows slowly, rarely metastasizes, and is highly radioresistant. Such growths fulfill most of the conditions favorable to surgery; that is, the disease may be diagnosed early; direct extension is limited for a considerable time by the barrier of the cartilaginous box of the larynx; and the lesions may be removed surgically with a safely wide margin by either partial or total laryngectomy, depending upon the local extent of the growth. On the other

hand, cancer lethal radiation for these highly radioresistant growths, centered directly on the vocal cords, is attended by a number of serious sequelae, including persistent lymphoedema of the glottis and late radionecrosis involving the cartilages. This does not imply that these growths can never be cured by radiation, but rather that surgery will produce far more cures with fewer dangerous complications. The argument that radiation is preferable because it preserves the vocal cords intact is hardly adequate, since the loss of the speaking voice is not too high a price to pay for the additional security.

In cancer of the extrinsic larynx these conditions are reversed. Malignant tumors of the epiglottis, the aryepiglottic folds or the arytenoids are mainly highly malignant, poorly differentiated epidermoid carcinoma or lymphoepithelioma. They grow rapidly, metastasize early and often bilaterally. Unlike intrinsic cancer, these extrinsic growths are often highly radiosensitive. Although occasional cures have been reported by surgical removal, it will be admitted by fair-minded laryngeal surgeons that growths of the aryepiglottic folds and arytenoids extending onto the lateral pharyngeal walls into the pyriform sinuses or into the base of the tongue can rarely be excised with a safely wide margin. The coincidence of metastases on admission in 65 per cent of the cases would make safe surgical removal even more remote.

TREATMENT OF CANCER OF THE INTRINSIC LARYNX

Referring again to the surgical treatment of cancer of the intrinsic larynx, there are two accepted procedures: (1) partial laryngectomy—often referred to as laryngofissure or hemilaryngectomy—and (2) total laryngectomy. Although partial laryngectomy in suitable cases is attended by a slightly greater chance of local recurrence or of the development of a new tumor on the opposite cord, these drawbacks are probably offset by the retention of the normal respiratory channel and of at least a hoarse whispered voice. It has been my experience that most intelligent patients, after a frank discussion of both sides of the question, are perhaps too willing to accept the additional risk of partial laryngectomy in return for the lesser deformity. As a matter of fact, the average patient is so eager to avoid total laryngectomy that he may be willing to accept an unjustifiable risk, and in doubtful cases the surgeon should assume the responsibility for selecting the extent of the operation and not leave the decision to the patient.

In small growths limited to the anterior two-thirds of one cord, not invading the anterior commissure nor extending back of the

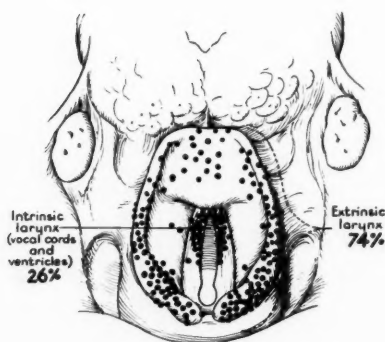


Fig. 2. The topographic distribution of cancer of the larynx. Extrinsic laryngeal cancer is three times as frequent as intrinsic or cordal cancer according to the records of all patients with this disease who apply to the Memorial Hospital. This diagram illustrates the location of the central point (probably the point of origin) of the growth in 265 consecutive cases.

vocal tubercle, it is my belief that partial laryngectomy should be advised. If the lesion extends across the anterior commissure onto the opposite cord with only moderate vertical extensions above and below the glottis, the patient is definitely happier with the lesser operation since he can at least force some air into the hypopharynx and produce audible speech.

For more advanced cancer of the intrinsic larynx, total laryngectomy is necessary. The growth in such cases may have deeply invaded the ventricle, extended onto the ventricular bands, across the anterior commissure to the opposite cord, up onto the posterior surface of the glottis or down into the subglottic region. In more extensive lesions where there is some doubt as to the exact site of origin of the growth, the decision for or against total laryngectomy should depend somewhat on histologic study. Should the growth be highly differentiated squamous carcinoma Grades I or II, with numerous epithelial pearls, the decision might be in favor of total laryngectomy, while if the tumor were of the less differentiated, more anaplastic variety, indicating an extrinsic origin, it would be more prudent to employ either fractionated x-radiation or laryngostomy with the implantation of interstitial radon.

If partial fixation of one side of the larynx is due mainly to invasion of the vocalis muscle, the growth may still be confined

within the cartilaginous box and, therefore, be curable by total laryngectomy. On the other hand, fixation with swelling of one arytenoid markedly reduces the possibility of complete removal of the growth.

Although the persistent hoarseness which accompanies cancer of the vocal cords will usually induce the patient to apply for treatment before he becomes dyspneic, he may delay until obstruction at the glottis forces him to seek relief. In a certain percentage of these cases, emergency tracheotomies are performed and the patient may not be offered further treatment or may refuse it, so that he eventually reaches a cancer clinic with an inoperable lesion. There are other instances in which the disease recurs locally after laryngectomy, and there are those rare cases in which a scirrhous form of intrinsic cancer may extend widely through the tissues of the larynx without producing sufficient obstruction to necessitate tracheotomy. Not all of these cases are incurable simply because they are inoperable. Treatment may be given by a permanent laryngostomy with the implantation of radon seeds. This method requires the use of a special instrument or laryngostat to maintain the patency of the laryngostomy opening. Such a combination of surgery and radiation has been successful in our clinic in about 50 per cent of the selected cases in which it has been used.

In all cases, before operation careful examination should be made for enlargement of any cervical nodes. I do not believe that total laryngectomy can be combined safely with neck dissection at the same operation. There is occasionally a fluctuant swelling in the midline of the neck at the level of the cricothyroid membrane which is due to metastasis and suppuration in the prelaryngeal lymph nodes. In some of these cases this process is complicated by direct extension of the growth through the cricothyroid membrane. Such a complication does not necessarily preclude the successful performance of total laryngectomy with primary healing.

TREATMENT OF CANCER OF THE EXTRINSIC LARYNX

For cancer of the extrinsic larynx there can be little question but that radiation is the method of choice, since these growths can seldom be removed with a safely wide margin by the standard forms of total laryngectomy. Lateral pharyngotomy as recently popularized by Trotter, a technically feasible operation, furnishes only a means of approach to the pharynx, but provides no method of excising an inoperable growth in this region. Even though an occasional small lesion in the extrinsic larynx could be widely excised

through this approach, one would still be faced with a better than even chance that the growth had already metastasized. In such a case neck dissection would be out of the question following lateral pharyngotomy, and just as heavy a dose of radiation would be required as if the primary growth had not been disturbed.

As has been previously stated, the average cancer of the extrinsic larynx is highly radiosensitive, and if these growths could be diagnosed in as early a stage as cordal cancer, the chance of cure would probably be almost as high by radiation as by surgery in cancer of the intrinsic larynx. Unfortunately, however, the growths of the extrinsic larynx produce few if any early symptoms and commonly metastasize and even disseminate systemically before a diagnosis can be made and treatment started.

It was in this group of cases that Coutard first demonstrated the value of the principle of fractionated radiation. Success depends upon accurately delivering cancer lethal doses to the primary lesion and to the metastases, and confining these radiation effects to the region of the growth itself so as to conserve as much as possible the local and general tolerance. It must be appreciated that radiation, like surgery, is a dangerous form of therapy even under the best conditions. While radiation in sufficient dosage is capable of destroying all growths and, as a matter of fact, all living tissue, success in the treatment of cancer depends upon a differential effect; that is, the administration of a dose lethal to the tumor but tolerable to the patient. One of the most important factors in this connection is the judicious limitation of the volume of tissue irradiated. In the more radioresistant and widespread growths, however, it is often necessary to approach the limits of both the local and general tolerance, and in an attempt to cure cancer, a certain percentage of postradiation fatalities is just as permissible as a reasonable percentage of postoperative deaths.

The administration of cancer lethal radiation to such a vital area as the larynx must be as accurate as a surgical procedure in the same area. The centering of the beam of radiation should be decided upon only after careful examination with a throat mirror and by palpation, and the position of the center of the primary lesion should be marked on the skin of the neck. In our clinic such marking is made permanent by tattooing with India ink. Daily examinations are made after the first two weeks of treatment in order to observe the increase and intensity of the radiation effect and to decide how long the treatment should be continued and what should be the

total dose. The number and size of the portals, the direction of the beam, and the size of the individual daily doses are variable factors, the details of which are beyond the scope of this paper.

It must be recognized, however, that surgery has a definite part even in such radiation therapy. In some cases radiation may increase the local swelling so that tracheotomy is necessary. In others the growth itself or the radiation reaction may produce sufficient obstruction in the pyriform sinuses so that sufficient nourishment cannot be obtained, and nasal tube feeding or even gastrostomy may be required. As the course of external radiation nears completion, the question of supplementary radon seed implantation frequently arises. Attempts at the radiation cure of laryngeal cancer by technic and dosages calculated to avoid these surgical complications at any cost will, in most cases, fall short of the dosage required for cure. If the radiation therapist is also a surgeon, not only is the selection of the nature and order of the therapeutic procedures simplified, but radiation therapy may be pushed to the limit of its possibilities for cure with complete confidence that any surgical complication may be recognized and dealt with adequately.

Much more progress will be made in the treatment of laryngeal cancer if surgeons give up the hope that, by propaganda, all patients with laryngeal cancer can be persuaded to apply for treatment while the disease is in an early, operable stage. This is an impossibility because the site of origin in the majority of cases renders the growth inoperable from the beginning. Improvements in surgical technic will hardly be so great as to permit the wide removal of vital structures which are often invaded by extrinsic laryngeal cancer. It is barely possible that improvements in technic may eventually permit the successful radiation treatment of radioresistant cancer of the vocal cords, but the fair-minded radiologist, who is competent to apply either radiation or surgery, will concede that at the present time no technic has been developed for the treatment of radioresistant cordal cancer which approaches surgery in its ability to cure.

In my opinion, cancer is always a surgical disease even when treated with radiation. Radiation therapy is not the first example of a valuable agent for the treatment of a surgical disease which the surgeon has been slow to adopt. It is my belief that future improvement in the control of cancer by our present methods depends mainly upon the combination of surgeon and radiation therapist in the same individual.

MEMORIAL HOSPITAL.

CAVERNOUS SINUS THROMBOSIS: A REPORT OF
THREE CASES WITH AUTOPSY FINDINGS*

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AND

ABRAHAM CUTLER, M.D.

BROOKLYN

Cases of cavernous sinus thrombosis are always interesting and frequently instructive. This condition is not common, although it is encountered often enough in a large institution to make the staff well acquainted with it. During the past ten years there have been admitted to the Kings County Hospital slightly more than fifty cases.

CASE 1.—A 56-year-old white laborer was admitted March 20, 1939. He had an upper respiratory infection nine days before admission; at this time he suffered pain in the right ear. On the third day he complained of pain in the lower part of the right jaw. For this a dental crown was removed from one of his lower molars. On the day following this dental manipulation, a swelling appeared on the right side of his neck, which gradually increased in size. In addition he had chills and fever. He could not sleep the night before admission because of severe frontal headache and pain localized to the right side of his face.

A profuse purulent discharge was coming from the patient's right ear. A peripheral facial paralysis was present on the same side. The discharge was increased by pressure upon the cervical mass. Otoscopic examination revealed a fullness of the drum membrane; a perforation was not present. Hearing was diminished. Tenderness was not elicited over the mastoid area at any time. There was no evidence of nasal disease. The swelling previously mentioned occupied the midportion of the side of the neck; it was the size of a small orange. Adjacent to this swelling there extended a cellulitis which was more prominent above and below.

*From the Otolaryngological Service of Dr. M. C. Myerson, Kings County Hospital.

On admission the temperature was 101.2 degrees, the pulse rate was 90 and the respiration rate 20 per minute. The urine contained 4 per cent sugar and a strongly positive acetone reaction. Several possibilities suggested themselves: (1) a cervical suppuration following a dental infection; (2) a cervical infection secondary to ear inflammation, in the form of a destructive mastoiditis with a complication facial paralysis and a Bezold's abscess. The facial paralysis might have been explained by the neck infection involving the nerve at its exit from the stylomastoid foramen. X-ray study of the mastoid revealed no evidence of bone destruction.

The abscess was incised and drained, using local anesthesia; one ounce of yellowish-white pus was evacuated. *Staphylococcus albus* was grown on culture. A profuse discharge continued from the external ear canal. On the day after operation the diabetes was well under control; the blood Wassermann reaction, however, was reported as 4 plus. On the third day, the patient complained of pain over the right eye, chemosis of the conjunctiva and weakness of the external rectus muscle were noted.

We were now dealing with what appeared to be an early cavernous sinus thrombosis due to extension of the infection by way of the pericarotid venous plexus. The probability of a cavernous sinus thrombosis by extension from the ear was not seriously considered because the otitic symptoms were so mild. On the fourth day, the chemosis, proptosis and fixation of the right eye had increased. Vision was good, however, and the neurological and fundusoscopic findings remained negative. During the next two days the changes in the periorbital structures progressed. At this time, the right pupil was found to be smaller than the left. It responded sluggishly to light and papilledema was present for the first time.

One week after admission, his temperature rose to 103 degrees. His neck was rigid; the spinal fluid was cloudy. Three days later the temperature declined, the ocular signs decreased and movement of the eyeball returned. The patient was less stuporous. Lumbar puncture yielded a slightly cloudy fluid, having an initial pressure of 120 mm. of water. The fluid contained 840 polymorphonuclear cells per cu. mm. The Tobey-Ayer test was positive on the right side. A Type III pneumococcus was isolated from the culture of the blood. On the following day, the patient became more stuporous. His diabetes was more difficult to control and he expired, after having spent fourteen days in the hospital. Large doses of sulphanilamide, transfusions, anti-diabetic and anti-luetic therapy were given.

Autopsy was performed. The mastoid process had been entirely destroyed. The inner part of the tip was necrotic; from this area a Bezold's abscess extended downward into the neck. Approximately one dram of pus was found directly over the sigmoid sinus, which was greenish and necrotic. Within it a thrombus was found extending downward into the inferior petrosal sinus. In the cavernous sinus, thrombi and pus were encountered; the superior ophthalmic vein was similarly involved. The temporosphenoidal lobe was covered with greenish-yellow exudate, and a small amount of pus was found on the posterosuperior border of the petrous pyramid.

Comment: Cavernous sinus thrombosis originating from an unsuspected ear focus in a diabetic and luetic individual is not very common. The offending organism proved to be the Type III pneumococcus. It is well known that diabetes, syphilis and this organism are each capable of causing the asymptomatic or painless type of mastoiditis. The point of origin of the infection was overlooked because of the mildness of the ear symptoms and the negative x-ray report. The appearance of signs of cavernous sinus thrombophlebitis soon after operation upon the neck, suggested the possibility of involvement of the pericarotid venus plexus or the pterygoid plexus as a starting point of the progressive blood vessel infection.

Involvement of the lateral or cavernous sinus by the Type III pneumococcus is most unusual. Its occurrence following sphenoidal infection, however, is not so uncommon.

CASE 2.—A 23-year-old white female was admitted March 23, 1939. She developed a cold ten days before admission. On the fourth day, she suffered severe left frontal headache which was not relieved by medication. Conservative nasal treatment brought improvement for one day. On the next day, however, a severe occipital headache developed, which was aggravated by movement of the head. She now complained of chilliness and fever, and vomiting on two occasions. She had had a similar attack of sinusitis six months before.

At the time of admission to the medical service, the patient complained of frontal and occipital headache. Although the temperature, pulse and respiration readings were normal, she appeared acutely ill. Examination of her eyes, including the nerve heads, was essentially negative. Her spinal fluid was removed under normal pressure; it contained three lymphocytes per cu. mm. A purulent exudate could be seen in both nasal chambers.

The headache became worse the next morning and the neck was rigid. A positive Kernig reaction was now present. Edema of the eyelids and conjunctiva, with slight proptosis of the left eye, had made its appearance. The temperature reached 104.8 degrees. The symptoms progressed and within a few hours both eyes were proptosed, more so the left, and small conjunctival hemorrhages were present. Extraocular movements were unimpaired. The spinal fluid contained 350 cells per cu. mm. of which 75 per cent were polymorphonuclear. Albumen was present, while sugar was absent. Organisms were not seen on direct smear. At this time the patient was referred to the nose and throat service. She was toxic and drowsy. Pressure over the right maxilla and both frontal sinuses elicited pain. Both olfactory sulci were filled with mucopurulent exudate; the same material was seen on the pharyngeal wall. The neck was markedly rigid. The conjunctiva of both eyes was chemotic; the eyes were proptosed. Although the eyes were not fixed, there was slight limitation of upper gaze on the left. The spinal fluid pressure was the equivalent of 14 mm. mercury. The fluid which was slightly cloudy, contained 1140 cells per cu. mm., most of which were polymorphonuclear. Sugar was absent. Cocci in long chains were found on direct smear. The nasal border of each optic disc was blurred and the retinal veins appeared fuller than normal. The condition was considered an acute exacerbation of a chronic sphenoidal sinusitis with complicating cavernous sinus thrombosis and meningitis.

A daily dosage of 120 gr. of sulphanilamide was being given.

March 25th, the patient was more responsive. The spinal fluid cell count was reduced to 470. No organisms were present but the pressure rose to 36 mm. of mercury. Cultures from the nasal discharge yielded a streptococcus, which was overgrown by staphylococci and the bacillus subtilis.

March 26th, the proptosis and chemosis of both eyes were more marked; fixation was complete. The retinal veins were engorged and the nasal border of each optic disc was edematous. On the following day, the patient seemed brighter. She answered questions intelligently. The eye signs were less pronounced.

Blood and spinal fluid cultures continued negative. The spinal fluid was slightly cloudy, containing 330 cells per cu. mm., all lymphocytes. There were no organisms and the pressure had decreased to 10 mm. of mercury. She was now getting 200 gr. of sulphanilamide

daily. The concentration of this drug was 4.5 mg. per 100 cc. of blood.

March 28th, the patient was stuporous and cyanosed from the effects of the sulphanilamide. The drug concentration was 6.7 mg. per 100 cc. of blood. The spinal fluid contained 1040 lymphocytes per cu. mm. The following day, the sixth day after admission, she seemed more promising. The eye signs had receded and there was some return of motion in the right eye. The blood cultures were still sterile. The spinal fluid contained 840 lymphocytes per cu. mm. The sulphanilamide concentration was now 14.3 mg. despite the fact that the dose had been reduced to 90 gr. daily.

During the next two days, the patient became more stuporous. Her temperature rose to 105 degrees, the pulse rate was 136, while respirations were 36 per minute. The proptosis and chemosis had subsided and the mobility of both eyes had markedly increased. Despite this, the systemic condition progressed unfavorably and the patient expired on the eighth day after admission.

Autopsy was performed. Purulent exudate was found on the left frontal and right parietal dura. The adjacent gyri were softened and covered with purulent exudate and a large amount of hemorrhage. The same material was found at the base of the brain. The superior longitudinal, right transverse and sigmoid sinuses were grossly normal. The left transverse and sigmoid sinuses were filled with fibrinopurulent material, which in some places was attached to the intima. This thrombus was traced to the jugular bulb. The superior petrosal sinus was uninvolved. The left inferior petrosal and cavernous sinuses, in addition to the left superior ophthalmic vein, were filled with a tenacious fibrinopurulent grayish-green mucoid material. The vein was markedly dilated; the posterior circular and right cavernous and inferior petrosal sinuses, together with the right superior ophthalmic vein was not involved. The partition between the sphenoidal sinuses had been almost completely destroyed, forming a single cavity, which was filled with grayish, yellow material. The ethmoid sinuses were similarly involved.

Comment: A 23-year-old female had an acute exacerbation of a chronic sphenothmoiditis. She had had a headache for ten days and had developed what appeared to be a cavernous sinus thrombosis the day after admission. A large quantity of pus was observed coming from both sphenothmoid regions. In addition to other treatment, she received large doses of sulphanilamide and small

transfusions. She lived for one week. During this time, the number of cells in her spinal fluid were reduced, the blood cultures remained sterile and the orbital signs receded. If operation had been performed upon the sphenothmoid regions before the orbital and meningeal signs pointing to a cavernous sinus thrombosis appeared, the surgery would very likely have been credited with the fatal outcome.

CASE 3.—An 18-year-old white delivery boy was admitted to the hospital April 5, 1939. He had had a severe cold for a week before admission. During the second day of his illness, he suffered severe occipital headache, necessitating bed rest. His headache was still present at the time of admission. For two days prior to his entrance to the hospital, he also had severe pain in the left ear. During his stay at home, he had vomited several times. When first seen at the hospital, he was stuporous and occasionally delirious. While at home his temperature reached 102 degrees. His previous personal history was irrelevant. He had had no previous nasal sinus infection.

At the time of admission, the patient constantly moaned because of excruciating occipital pain. His pupils were small and reacted sluggishly. The right eye had limited motion, it was markedly proptosed and the conjunctiva was chemotic. The veins of the upper lid were markedly engorged. The left eye was limited on outward gaze, probably because of an old strabismus. The right optic disc was somewhat blurred, the retinal veins were extremely filled. The left fundus was clear and the vision of this eye unimpaired. Rhinoscopy revealed mucopurulent exudate coming from the posterior ethmoid and sphenoid areas. The same type of thick discharge covered the posterior pharyngeal wall. The right frontal area was tender on pressure. The ears were uninvolved. The neck was rigid; suggestive Kernig and Babinski reactions were present on each side.

The spinal fluid was withdrawn under a pressure of 20 mm. of mercury. It was slightly cloudy and contained 120 cells per cu. mm., 90 per cent of which were polymorphonuclear. A gram positive diplococcus was discovered on smear but not on culture. Several hours later the cell content had risen to 500. Culture of the spinal fluid now revealed the presence of the staphylococcus aureus. The same organism was present in the blood. Blood study revealed 18,200 white cells, 90 per cent polymorphonuclear, and 4,000,000 red blood cells. The hemoglobin percentage was 90.

The condition was thought to have originated from the right sphenoidal sinus. Although the patient's condition was critical and he had a cavernous sinus thrombophlebitis with meningitis, the right sphenoidal sinus was operated upon under combined tribromethinol and cocain anesthesia. The posterior part of the nasal septum and both middle turbinates were removed. Then both sphenoidal sinuses were converted into a single cavity by excision of their anterior walls. The floor of the sphenoidal sinuses were also resected. A small amount of sanguinopurulent secretion was encountered in the right sinus. The patient did not react well to his operation and died during the night.

An autopsy was performed. The dura over the anterior part of the middle fossa was moderately hemorrhagic and edematous. The blood vessels throughout the brain were engorged. On the right, the cavernous sinus, the proximal half of the inferior petrosal sinus, and both ophthalmic veins were occluded by a disintegrating soft, grayish-red thrombus. The covering of the posteroinferior surface of the frontal and temporal lobes was thickened and hemorrhagic. There was marked edema of the superficial brain substance. The base of the brain was covered with a mucopurulent exudate. The same material was found in the sphenoidal cavity.

Comment: This was a case of fulminating cavernous sinus thrombophlebitis which followed an acute sphenoiditis. The seriousness and significance of the persistent occipital headache was not appreciated before admission. It had lasted for a week and was mistakenly considered to be due to influenza. Perhaps earlier attack upon the sphenoidal sinus might have saved this patient. There was no extension of the thrombophlebitis to the other side. The staphylococcus aureus was the offending organism. It was not influenced by the administration of sulphanilamide. The patient was in the hospital for one day.

SUMMARY

Three cases of cavernous sinus thrombophlebitis are presented, two of which occurred while the patients were in the hospital. They demonstrate the difficulty of recognizing a sphenoidal sinus infection which is threatening involvement of the meninges or cavernous sinus. They demonstrate also how difficult it is to make a diagnosis when the patient is seen in the home, and how easy the pathway of extension can be overlooked in some cases.

The otolaryngologist should not hesitate to attack surgically a nasal sinus or ear which is causing persistent and severe headache.

This symptom, together with other signs, frequently indicates an impending intracranial complication. Sulphanilamide or one of its related compounds may yet prove to be of value in some of these cases. Seydell has recently reported a recovery in a case following an otitic infection.

277 E. PARKWAY.

LVII

TEMPORO-SPHENOIDAL BRAIN ABSCESS WITH
OPERATION AND RECOVERY*

WILLIAM L. McDougall, M.D.

ATLANTA

The following case of infection extending from the mastoid bone into the meninges and brain as a complication of suppurative mastoiditis is rather unusual, and I feel that it is worthy of reporting.

L. K., an 11-year-old white school girl, was referred on May 12, 1939, by her physician, with the following history:

In 1937 she had an acute glomerular nephritis, with a complete resolution after her tonsils were removed. She had an acute catarrhal otitis media in the left ear the same year. Otherwise her past history was insignificant.

The present illness began on May 3rd, with an upper respiratory infection, i. e., sore throat, coryza, and bronchitis, which subsided under treatment in due time. The past three days she had complained of severe temporal and frontal headaches on the right side with a temperature ranging from 100 to 102½ degrees. On May 10th, there was slight pain in the right ear with an acute inflammation of the right tympanic membrane. A myringotomy by Dr. Walker released a fair amount of pus from the middle ear. On May 12th, a slight stiffness of the neck occurred. A moderate amount of purulent secretion was discharging from the ear. There was no nausea, no vomiting; the temperature was 102 degrees, pulse 100, and respirations 22. The chest was normal and urinalysis negative. A spinal cell count showed 830 cells with 80 per cent polymorphonuclear cells. Spinal culture was negative. Smears from the spinal fluid showed no bacteria. Smears of the pus from the right ear showed many short chain streptococci with a few pneumococci. Neo-prontosil had been given for the past twenty-four hours, five grains every four hours, by mouth.

*Read before the Southern Triological Society at Columbia, S. C., January 9, 1940.

The child was brought to Atlanta and admitted to Eggleston Memorial Hospital the afternoon of May 12th, where I examined her with the following findings:

A white female apparently eleven years of age, and complaining of severe headache and pain over the right frontal and temporal regions. The temperature was 103 degrees, pulse 130, respirations 24. The left ear was normal throughout. There was a moderate purulent discharge in the right canal, and a good opening was seen in the tympanic membrane. There was no sagging of the canal walls, the hearing was moderately impaired, and there was no post-auricular edema. No pain was elicited on pressure over the mastoid antrum, tip, or emissary vein. There was incoherence of speech, and there was a marked bluish discoloration of the entire skin of her arms, chest and legs. The eyes reacted to light and accommodation, and ocular fundi were normal. The pharynx was slightly injected, the tonsils had been cleanly removed. The nose was free from pus and the membranes normal in appearance. The nasal sinuses were apparently normal. The abdomen was soft and not tender. There was moderate rigidity of the neck; the reflexes were not increased; the Kernig and Brudzinski signs were negative. Examination of the heart and lungs by Dr. Dickson showed no abnormalities. The blood count was 4,000,000 red cells and 18,500 white cells, hemoglobin 73 per cent, and there were 65 per cent polymorphonuclear cells, 15 per cent large lymphocytes and 20 per cent small lymphocytes.

The roentgenograms of the left mastoid revealed a pneumatic type of cells, well developed, and clear throughout. The right mastoid is pneumatic in type, well developed; the sinus is not shown, and there is an extensive zygomatic development. The post-antral cells are cloudy. The tip cells are also cloudy; there appears to be no definite cavitation and the cell trabeculae are apparently intact. A lumbar puncture was done, the fluid was under considerable pressure, slightly turbid, and an examination of the fluid showed no organisms by smear. There were 1200 cells per c.mm. The albumens and globulins were not increased. Culture of the spinal fluid was negative at the end of twenty-four hours. Blood culture was negative after twenty-four hours' incubation.

On May 13th, the spinal puncture showed the fluid under moderate pressure, slightly turbid, and there were 850 cells per c.mm. No organisms were found on smears and the culture remained sterile at the end of twenty-four hours. The pus from the right

ear was slight, the temperature remained between 102 and 103 degrees. There were no definite chills, but chilly sensations were complained of.

On May 14th, there was a moderate swelling of the elbow, knee and ankle joints on both sides. They were extremely sensitive to touch, and mentally she was sluggish, answering questions with difficulty. The temperature was 103 degrees, the restlessness increased, the stiffness of the neck increased, and the Kernig and Brudzinski signs were negative. The ear looked the same as on admission, May 12th, except that there was slight pain on pressure over the mastoid antrum. The pain in the temporal and frontal regions continued. An x-ray of the right mastoid showed less inflammation of the cells around the antrum and tip as compared with the previous films. The cells appeared definitely clearer. Examination of the pus from the right ear showed many short chain streptococci and a few pneumococci. On May 15th, a spinal puncture revealed 820 cells per c.mm. It was slightly turbid, and under slight pressure. Smears and culture of the fluid showed no organisms present. There was less swelling of the joints and less stiffness of the neck. The pulse was 140 and the temperature was 103 degrees. Examination of the chest showed the lungs to be clear, the heart slightly enlarged, and there was a soft blowing murmur heard over the mitral area. There were 4,250,000 red cells and 17,500 white cells. The hemoglobin was 78 per cent and there were 75 per cent polymorphonuclear cells. The eye grounds remained normal. There was less mental confusion and less restlessness.

On May 16th and 17th, the temperature remained between 102 and 103 degrees, and her condition was about the same as the day before.

On April 18th, 8:00 a. m., the temperature was 104 degrees, the pulse 140 and respirations 36. Headache was more severe. The reflexes were normal; the rigidity of the neck was less; the swelling of the joints less; and the patient was extremely restless and incoherent. An immediate mastoidectomy was advised, this being the fifth day after admission to the hospital, and the sixth day after the onset of the pain in her ear.

A preoperative diagnosis of (1) acute suppurative mastoiditis, (2) external pachymeningitis, (3) acute bacterial endocarditis, (4) bacteremia, (5) acute rheumatic arthritis, was made.

A mastoidectomy was done under nitrous-oxide-ether anesthesia. The mastoid cortex was found to be intact and was removed.

A group of cells behind the antrum 1 cm. in diameter was soft and necrotic and contained thick pus. Several tip cells were necrotic and contained pus. The sinus plate was intact. The dural plate was eroded in its entirety, and the dura was found exposed in the middle fossa and was bulging into the mastoid area. The dura was considerably thickened and was greenish-black in color. After the mastoid cells were exenterated and the aditus ad antrum opened, a crucial incision was made in the bulging dura in the middle fossa and from four to six cc. of thick foul-smelling pus was evacuated from an abscess in the right temporo-sphenoidal area of the brain. Smears were made from the pus and organisms of short chain streptococci were abundant on the smear.

A probe was passed approximately one inch up into the abscess cavity which was about four to six mm. in width. A wide area of bone was then removed from around the dura in the middle fossa until healthy dura appeared. Two cigarette drains were placed in the abscess cavity. One strip of plain gauze was lightly packed in the mastoid cavity, and one strip in the canal. The usual dressing was applied. The patient was returned to her room in fairly good condition.

Postoperative Diagnosis: (1) Acute suppurative mastoiditis; (2) external pachymeningitis; (3) acute rheumatic arthritis; (4) acute endocarditis; (5) temporo-sphenoidal abscess.

Therapy: Spinal puncture daily until the cell count had decreased to twelve, and was clear and under no pressure, removing 15-20 cc. of spinal fluid at each puncture.

Sulfanilamide gr. x q.6 hrs; sulfapyridine, gr. xv, 6 times daily, alternating 24 to 48 hours. Pantopon, gr. 1/12, for pain.

Transfusions 150-250 cc. whole blood at 2-3 day intervals; 5 per cent glucose with saline solution intravenously, 500-750 cc., 8-12 hour intervals. Caffeine-sodio-benzoate 3½ gr. q 4 hours, as needed for cardiac stimulation. Coramine m. xv, q 4 hours, for several days. Phenobarbital, ½ to 1 gr. for rest. Dressing changed 2-3 times daily due to profuse drainage from the brain abscess cavity.

Postoperative Course: There was a stormy convalescence for the first three days. On the second day an extensive diarrhea developed, lasting twenty-four hours. The temperature was 104 to 105 degrees, pulse 140 to 160, and respirations were 30 to 34. Sulfanilamide and sulfapyridine were continued for the next eight days, alternating from one to the other. On April 28th, the temperature

dropped to 99 degrees, pulse 80, and respirations 24, at which time the dyes were omitted.

The blood count was 4,500,000 red cells, 10,500 white cells, with 83 per cent hemoglobin, and 73 per cent polymorphonuclear cells. From April 28th, to June 10th, the patient gradually improved in every respect. She had lost twelve pounds in weight since her illness began. On June 10th, she was allowed in a rolling chair. On June 26th, the fortieth day after the operation, she was dismissed from the hospital and returned to her home, with no drainage from the brain abscess or mastoid cavity, the wound being practically healed.

On September 20th, her physician advised that the patient had gained fourteen pounds, was eating well, sleeps well, and the heart was normal in size and no perceptible murmur was heard over the mitral area, and she entered school September 15th.

On October 30th the patient visited my office looking and feeling well, and the ear had completely healed. An audiogram showed a loss of 24 db. in the right (operated) ear and a loss of 10 db. in the left ear.

Comment: The diagnosis of brain abscess was not made before the operation. Acknowledgment is made of the consultations with Dr. Roger Dickson and Dr. Calhoun McDougall. Recovery of this patient in spite of her severe complications naturally leads one to believe that intensive sulfanilamide and sulfapyridine therapy should be used as a supportive measure to surgical drainage of suppurative lesions caused by streptococcic and pneumococcic infections of the brain and mastoid bone.

915 DOCTORS' BUILDING.

LVIII

ROENTGEN THERAPY FOR ACUTE SINUSITIS*

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AND

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Dysart¹ in 1939 and Gatewood² in 1940 published extensive reviews of the literature on the use of roentgen therapy in otolaryngology. Dysart, who was seemingly in favor of this method of therapy, was able to discover many reports favorable to this method of treatment. Gatewood, on the other hand, reported many unfavorable observations. It is interesting to note that only in an article by Haidenhain and Fried did the two authors duplicate one another's review. For this reason one article is an excellent supplement to the other and between them they cover the literature so thoroughly as to render any duplication of their efforts supererogatory. Dysart quoted Desjardins³ and Gatewood quoted Larsell and Fenton⁴ to the effect that roentgenologic treatment depends on destruction of the leucocytic infiltration in the submucosa of the sinuses. Desjardins expressed the belief that this destruction makes the protective substances within the cells more readily available for defense purposes than they are in the intact cell. Larsell and Fenton stated that the effect of roentgen rays is due to the destruction of the lymphocytic infiltration alone, the breaking down of which causes an increase in the number of macrophages in the submucosal tissues. Dysart concluded that a review of the literature on roentgenologic treatment of inflammatory conditions shows much favorable and little unfavorable evidence. He believed that in acute conditions treatment should be started as early as possible and that small doses produce better results than large doses. He reported several cases of acute sinusitis in which roentgen treatment produced good results.

Gatewood, on the other hand, stated that the fact that most of the literature on the subject of the treatment of sinusitis with roentgen rays had been produced by the radiologist alone made it difficult

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to evaluate the end results reported. He felt that roentgen therapy for any form of sinusitis was in the earliest experimental stage and that it was essential for the rhinologist to make the final examination to avoid erroneous conclusions. In eight cases in which the lining membranes were later surgically removed, he subjected the antrums to roentgen therapy. Microscopic study of the membranes did not show any obvious difference from similar pathologic contents of other antrums which had not received like treatment.

In reading these reviews it is obvious that Dysart reported results in treatment of acute conditions, whereas Gatewood treated chronic conditions alone. One feels that Dysart is perhaps unduly enthusiastic about results obtained in his series of cases. Neither is it immediately apparent why Gatewood should expect a different type of fibrosis in a case in which the patient had been treated with roentgen rays than in one in which the patient had not received such treatment. These papers are typical of the lack of unanimity of reports on the use of roentgen therapy for sinusitis. It was thought, therefore, that a roentgenologist and a rhinologist working in conjunction might resolve some of the difficulties and doubts which previous reports in regard to the roentgen therapy of sinusitis had raised, and we decided to apply roentgen therapy to patients with sinusitis in an attempt to evaluate the results. Because of the large doses required in chronic sinusitis which might make subsequent roentgen therapy for other and more serious conditions dangerous, and because of the difficulty in evaluating both the severity and the end results in chronic sinusitis, it was decided to omit such cases from consideration. To make diagnosis less open to doubt and the results of therapy easier to evaluate, it was decided to accept for treatment only those cases of acute sinusitis in which pain and tenderness were the principal symptoms.

The cases were divided on clinical grounds into moderate and severe types. Cases of moderate type were assumed to be those in which the patient would tolerate a repetition of firm pressure over the affected sinus or sinuses and in which the pain did not require morphine for relief or did not seriously interfere with sleep. Cases of severe type were assumed to be those in which the patients would not willingly submit to a repetition of moderately firm pressure over the involved sinuses and in which the pain and headache were severe enough to prevent sleep or to require morphine for relief. In addition, cases in which the patients were ill enough to require hospitalization or in addition had an associated condition such as acute

hemorrhagic nephritis or orbital abscess were included in the group of severe cases.

Good results were assumed to be disappearance of pain within one to six hours after the roentgen treatment, disappearance of tenderness within the same interval of time, disappearance of congestion from the nasal mucosa and cessation of discharge into the nasal chambers from the sinuses. The majority of the patients received additional treatment by the Dowling pack method, although in many cases relief by this method had failed to ensue before roentgen therapy was instituted. In the cases in which the patients were ill enough to require hospitalization, hot compresses were used in addition. For a few of the more severely ill patients sulfonamide drugs were also used.

It was thought that the patients selected for this study were both ill enough and had sufficiently marked symptoms so that they would at once offer a severe enough test of the method of therapy and an opportunity for definite evaluation. The fact that more than one therapeutic method was used in many of the cases in this series makes it necessary to confine ourselves to reporting clinical impressions rather than definite percentages of improvement. The latter feat is rendered additionally difficult by the fact that acute sinusitis tends to spontaneous recovery, that is to say, that in any method of therapy in this infection one is assessing the effectiveness of the defense mechanisms of the body in addition to the effect of the specific therapy used.

Fifty-six patients were treated. Thirty-one cases were classified as being in the group with severe involvement and twenty-five were classified as being in the group with moderately severe involvement. Because of reports in the literature that treatment was more effective early in the course of the infection than late in the course of infection, we arbitrarily divided both groups into those in which symptoms had been present for one to five days before the beginning of treatment and into those in which symptoms had been present more than five days.

In the group of cases of severe sinusitis, of those in which pain and tenderness had been present from one to five days before roentgen therapy was instituted, there were six cases in which pain and tenderness disappeared within six hours after the first treatment and one in which pain and tenderness disappeared abruptly after the second treatment. In an additional case in which rather heavy doses had been used, symptoms were increased for three days and then

stopped abruptly with complete cessation of nasal discharge and inflammatory swelling of the nasal mucosa on the evening of the third day. In two other cases, pain and tenderness continued until after the third treatment when they suddenly disappeared. These were classified as moderately good results. In three cases no apparent effect from the application of roentgen therapy could be noted.

There were eighteen cases in which severe sinusitis had been present for more than five days. Of these there were nine in which pain and tenderness disappeared after the first treatment and two in which these symptoms and signs disappeared after the second treatment. These were assumed to be good results. Pain and tenderness disappeared in one case after the third treatment. This was assumed to be a moderately good result. In six cases no apparent effect of roentgen therapy could be noted. In one of these cases trephination was required because of edema over the frontal area and high fever with leucocytosis suggesting beginning osteomyelitis of the frontal bone. Another patient in this group had a complicating orbital abscess and an abscess of the frontal lobe. This patient died three months later from the effect of the abscess of the frontal lobe. This is the only death in the series.

In twenty-five cases the patients were classified as having moderately severe sinusitis. These were also arbitrarily divided into a group in which symptoms of pain and tenderness had been present for one to five days before the beginning of treatment and into one in which they had been present for more than five days. Of the cases in which symptoms had been present for one to five days there were eight cases in which pain and tenderness disappeared after the first roentgen treatment and one in which such response was delayed until after the second treatment. There were no cases in this group in which the patient showed no response to treatment. There were sixteen cases in which symptoms of pain and tenderness had been present more than five days. Of these there were eight cases in which there was complete remission of pain and tenderness within six hours after the first roentgen treatment.

There were six cases in which only a moderately good result was obtained. One patient who received an unusually heavy dose had an increase in pain and tenderness for four days with an abrupt cessation at the end of that time of all symptoms of sinusitis, including pain, tenderness, discharge and evidence of congestion of the nasal mucosa. In five other cases, although pain and tenderness were relieved, discharge into the nose seemed unusually prolonged.

In another case in which the patient apparently secured complete relief after the first treatment, there was a recurrence of symptoms two weeks later which required the removal of a diseased pharyngeal bursa and submucous resection of the nasal septum. In two cases there was no apparent effect from roentgen therapy.

METHOD OF TREATMENT

Because of our experience in treating other acute inflammatory conditions we felt that acute sinusitis might be treated equally well with relatively small doses of roentgen therapy. Only those sinuses giving symptoms and showing objective evidence of involvement were treated. If the patient was diagnosed as having pansinusitis, all the sinuses were treated. Otherwise only the sinus or sinuses involved were treated. The doses used in each case were in accordance with the duration and severity of the infection.

In cases with symptoms of one to five days' duration, doses of 50 r were used. In those cases in which the duration of symptoms was more than five days, doses of 75 to 100 r were used. For each patient treatments were repeated on alternate days, from one to three treatments being given, depending on the symptomatic response. The treatments were given with voltages generated at 130 kilovolts (constant potential) filtered through 6 mm. of aluminum except for children, for whom a filtration of 4 mm. of aluminum was used at a distance of 40 cm. The portals in each case were sufficiently large to cover adequately the sinus or sinuses involved as well as the areas of nasal mucosa contiguous to the natural ostia of the sinuses involved.

CLINICAL IMPRESSIONS

The most striking effect of roentgen therapy of acute sinusitis is the relief of pain and headache. Such relief is noted early in cases in which there are favorable results from this type of therapy. This relief of pain is often accompanied by a noticeable increase in the discharge, so that the effect of roentgen therapy on the sinuses may be due to diminishing the engorgement of the nasal mucosa. This effect is definitely observable. If no other effect were obtained, symptomatic relief is great enough to justify the use of this therapeutic method. More good results seemed to be obtainable when therapy was instituted early, and the results seemed to be better in an initial attack of sinusitis than in a recurrence after one or more previous attacks. Although not implicit in the material presented,

there seemed to be an effect of preventing recurrence of infection in cases in which patients had previously been subject to repeated recurrence of attacks of acute sinusitis. While roentgen therapy can by no means be depended on as the sole therapeutic agent in cases of acute sinusitis, it would seem to form a very useful adjunct method of therapy, especially in regard to symptomatic relief. It is suggested by this study that the severity of the symptoms and the duration of the disease are inverse to the therapeutic results obtainable.

MAYO CLINIC.

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LIX

THE EFFECT OF X-RADIATION ON TONSILLAR TISSUE

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The lethal effect of x-radiation on glandular tissue is well known. A number of attempts have been made to use this effect in reducing hypertrophied tonsillar tissue, and particularly it is the practice of some otolaryngologists to resort to x-radiation for the treatment of tonsillar or adenoid remains after partial removal of these tissues. Because of the time, discomfort and expense involved in tonsillectomy, we decided to determine whether or not x-radiation is effective in eradicating or materially reducing the tonsillar tissue in a group of twenty miscellaneous cases. It is sometimes difficult to decide whether therapeutic procedures for relief of upper respiratory symptoms are effective because of other factors contributing to the health or ill health of the individual, and because of the variation in upper respiratory infections from season to season. We have, therefore, judged the result of x-radiation on the tonsillar tissue in these cases purely upon the size of the tonsillar tissue. Eighteen of the patients were followed at three months, six months and one year after x-ray treatment. Two were followed only for six months.

The patients received 200 r units x-ray therapy centered on each tonsillar area from lateral portals, a total of 400 r units at one sitting. Treatment was given at weekly intervals for three weeks, making a total of 600 r units to each tonsillar area. The treatment factors were 200 K.V.P., 20 milliamperes, a 4 x 5 centimeter cone at 50 centimeter distance filtered with one-half millimeter copper and one millimeter of aluminum. Treatment was carried out at the Massachusetts General Hospital.

The tonsils were graded in size as follows:

Grade 1: Tonsillar remains or buried tonsils not appearing beyond the pillars.

Grade II: Tonsils large enough to be level with, or just beyond the pillars, and definitely not large, embedded tonsils.

Grade III: Definitely enlarged tonsils.

Grade IV: Very large tonsils, almost meeting in the midline.

The group of 21 patients observed is miscellaneous. We wish to avoid a discussion of indications for tonsillectomy. It is perhaps safe to say that several of these patients would be considered candidates for tonsillectomy by most observers.

OBSERVATIONS

1. Female, aged 15. History of frequent abscesses in right ear with and without colds. Tonsils normal in size, Grade II, left a little more prominent than the right. No reduction in size of the tonsils three months, six months and one year after x-ray treatment.

2. Female, aged 16. History of hypertrophic rhinitis. Septum straight. Ears not remarkable. No adenoid tissue. Tonsils normal in size, Grade II. There was no reduction in size of the tonsils until one year after x-ray treatment, when they were slightly smaller, Grade I.

3. Female, aged 23. History of ears negative. Nasal septum deviated to left at base. Nasopharynx clean. Tonsillar remains small and superficial, Grade I. No change in the size of the tonsils three months, six months and one year after x-ray therapy.

4. Female, aged 15. Adenoids unable to be seen. Septum straight. Tonsils imbedded, Grade II. No reduction in size of tonsils three months, six months and one year after x-ray treatment.

5. Female, aged 19. Nose negative except for right moderate basal septal spur. Ears negative. Right tonsil large and more prominent than left. Tonsils Grade II. Tonsils slightly smaller, Grade I, three months, six months and one year after x-ray treatment.

6. Male, aged 16. Nasopharynx clean. No adenoids. Nose and ears negative. Tonsils of good size, imbedded, Grade II. No appreciable change in size of the tonsils three months, six months and one year after x-ray treatment.

7. Male, aged 16. Small amount of adenoid tissue. Nose negative. Good-sized tonsils, Grade II. Three months after x-ray treatment tonsils were Grade I, but six months after treatment were Grade

II. In a year there was slight improvement and they were again Grade I.

8. Female, aged 16. History of frequent earaches in the winter, and occasional abscesses in left ear. Left drum scarred. Small central mass of adenoid tissue. Nose negative. Left tonsil more prominent than right. Tonsils Grade II. Three months after x-ray treatment the tonsils remained the same, but were Grade I six months after treatment.

9. Male, aged 16. History of otitis media as a child. Left ear drum scarred and healed. Nose negative. Very large tonsils, Grade III, which x-ray treatment failed to reduce. Observed for one year.

10. Male, aged 16. Ears and nose negative. Tonsils of good size, Grade II. There was no reduction in size of the tonsils three months, six months and one year after x-ray treatment.

11. Female, aged 14. History of vasomotor rhinitis. Large central mass adenoid tissue. Ears negative. Occasional tonsillar abscess. Very large Grade III tonsils, which remained the same three and six months after x-ray treatment but appeared larger, Grade IV, in one year.

12. Male, aged 13. History of earaches, otitis media and brain abscess. Very large tonsils, Grade III. X-ray treatment did not effect any reduction in the size of the tonsils three months or six months after treatment.

13. Female, aged 13. History of ear aches. Ears and nose negative. Small tonsils, Grade II. There was no improvement in the tonsils three months, six months and one year after x-ray treatment.

14. Female, aged 13. Ears and nose negative. Tonsils, Grade II, unaffected by x-ray treatment three months, six months and one year after treatment.

15. Male, aged 14. Ears and nose negative. Small tonsils, Grade I. X-ray treatment was ineffective in reducing the size of the tonsils three months, six months and one year after treatment.

16. Male, aged 11. Nose negative. Ears negative except for right mastoid scar. Very large tonsils, Grade IV. The tonsils remained Grade IV three months, six months and one year after x-ray treatment.

17. Female, aged 10. Nose and ears negative. Left tonsil more prominent than right. Tonsils, Grade II, unchanged three months, six months and one year after x-ray treatment.

18. Male, aged 7. Ears and nose negative. Right tonsil more prominent than right. Tonsils Grade II. There was no reduction in size of the tonsils three months, six months and one year after x-ray treatment.

19. Male, aged 11. History of deviated septum and sinus disease—sinusitis. Ears negative. Tonsils Grade II. Condition of tonsils the same three months, six months and one year after x-ray treatment.

20. Male, aged Ears and nose negative. Tonsils large, Grade II. No change in size of tonsils three months after x-ray treatment, but smaller (Grade I) six months after treatment.

21. Female, aged 19. X-ray treatment did not reduce the size of large tonsils, Grade III, three months, six months and one year after x-ray treatment.

SUMMARY AND CONCLUSIONS

Twenty-one patients with varying degrees of upper respiratory pathology and varying susceptibility to sore throats have been given x-ray treatment to the tonsils without any notable effect in reducing the amount of tonsillar tissue. In five, the tonsils appeared slightly smaller following x-ray treatment. In one, the tonsils were definitely larger. The changes in appearance and size of tonsils noted in this group after x-ray treatment were no different than the changes seen in any group of children or young adults, observed for one year.

It is our conclusion that x-ray treatment in the dosage given does not materially reduce or eradicate tonsillar tissue.

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ST. LOUIS

Clinical Notes

LX

EXTENSIVE INTRANASAL DESTRUCTION: A PATHOLOGICAL SPECIMEN

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Although the literature contains many reports of necrosis of intranasal structures, this specimen is reported because of the accessibility of the entire nasal cavity for inspection and because of almost complete destruction of the nasal septum and nasal conchae with involvement of a considerable portion of the walls of the cavity.

This nasal cavity was found during routine class dissection, and belonged to an adult negro female who had fortunately attended the clinic in the Grady Memorial Hospital for many months before her demise at the age of 31. Consequently, it is possible to present the clinic record and laboratory data.

REPORT OF A CASE

A. P., a 28-year-old negress, first reported to the surgical clinic on September 15, 1930, and was referred to the medical clinic, to which she reported on September 18, 1930, complaining of a sore mouth.

Her past history revealed a 4 plus Wassermann in 1926, followed by one shot, presumably antiluetic. She then got sick and because of lack of money did not return for further treatment. She had been married ten years with one pregnancy, the baby dying at the age of one year. Under past illnesses were reported an appendectomy at fourteen years of age and a statement that three or four years before her nose had suddenly "given away" from "catarrh." (This is the only reference to nasal symptoms in the record.)

Physical examination: The blood pressure was normal. There was an increased aortic second sound, and aortic dullness. The pupils were irregular but active. The knee-jerks were normal. There was



Fig. 1. Photograph of the right half of the skull showing the right lateral wall of the nasal cavity still covered by soft tissues.

extensive pyorrhea. The nose was described as having a sunken bridge and a necrotic septum with only a small part left where it separated the external nares.

The Wassermann was slightly positive on September 22, 1930.

Potassium iodide and bismuth were started, and she was given a mouth wash for pyorrhea.

She received colloidal bismuth intramuscularly ten times before October 24, and was not seen again until January 1, 1931.

Between January 1, 1931, and July 3, 1931, she received, irregularly, 17 intramuscular injections of colloidal bismuth. On May 27, 1931, the Wassermann was four plus.



Fig. 2. Photograph of a similar view of the left half of the specimen after cleaning the bones by removing the soft tissues.

She did not return for a year, appearing on June 7, 1932 to complain of loss of weight, vomiting, shortness of breath, nervous sweating, loss of appetite, coughing, and diarrhea for two months or more. B.P. 110/66. Pulse 144.

Antiluetic treatment was begun again. X-ray, June 6, 1932, showed pulmonary tuberculosis. The Wassermann was two plus on June 11, 1932. At the same time, the sputum was reported positive for *B. tuberculosis*.

Urine examinations from time to time had shown a few pus cells and, on one occasion, a trace of albumen.

The patient died January 12, 1933.

Description of Specimen: The nasal cavity was exposed by a saw-cut in a sagittal plane just to one side of the median line. There was no trace of nasal conchae. The only remaining portion of the septum was a small bar separating the external nares. All sinus ostia were enlarged and there was extensive trabeculation of the mucosa.

Fig. 1 shows a lateral wall of the opened nasal cavity, at the center of which is the enlarged ostium of the maxillary sinus. The trabeculation of the mucosa is obvious. On the cut surface of the bone the sphenoid and the frontal sinuses appear. Near the posterior end of the lateral wall of the cavity, the opening of the eustachian tube may be seen.

Fig. 2 is a similar view of the opposite half of the nasal cavity after removal of all soft tissues. The bony ostia are much larger than the openings through the soft tissue. In this view, the center of the lateral wall is occupied by the tremendous ostium of the maxillary sinus, above which are the enlarged ostia of the middle and posterior ethmoid cells. Immediately behind the ostium of the maxillary sinus is the sphenopalatine foramen. Just above the anterior angle of the maxillary ostium is the opening for the nasolachrymal duct. Just below the frontal sinus is the enlarged ostium of that sinus which, due to the fact that the medial wall of the orbit has been cut, appears to connect with the orbit. Posteriorly, in the body of the sphenoid, the sphenoid sinus can be seen.

Microscopic sections of the soft tissue from several regions showed only marked fibrosis.

SUMMARY

A resumé of the history and a brief description of the nasal cavity of a negress, 31 years of age, having positive signs of tuberculosis and syphilis are presented. The extensive destruction of both soft and bony nasal structures might have been due to either the tuberculosis or the syphilis. The availability of the specimen for description and illustration is dependent upon the fact that the body was received for dissection.

CHONDROMA AND FIBROMA OF THE SUPERIOR
MAXILLA: REPORT OF TWO CASES

DURWIN HALL BROWNELL, M.D.

SAN DIEGO

Simple chondromas and fibromas of the maxilla are uncommon, if one can judge the incidence by the number of case reports, for very few have been recorded in any language in the past fifteen years. That these benign lesions can become very serious is shown by the outcome of these two cases studied and treated on the otology service of A. C. Furstenberg, University Hospital, Ann Arbor, Michigan.

CASE 1.—A 13-year-old Italian girl first noticed painless swelling of the right cheek about February 15, 1936. There were no nasal symptoms. The general health had always been good and was unaffected when she was first examined in the otology clinic on March 2, 1936. The right upper alveolar ridge was widened to twice the normal dimension about the canine and premolar teeth (Figs. 1 and 2).

This mass had a firm, homogeneous consistency somewhat suggesting hard rubber. Over the inner aspect of the ridge there were two small ulcerations of the mucosa so that the underlying tumor was exposed. The right antrum was dark on transillumination. The rest of the otological and the general physical examinations were negative. Sinus films showed no evidence of involvement of the right antrum. A biopsy was done and reported, "Ulcerating chondroma, not sufficiently cellular in the portion submitted to be considered sarcomatous."

On March 20, 1936, the right upper alveolar ridge was resected under general anesthesia. The tumor had not entered the antrum but the anterior wall was destroyed, so that the antrum was widely opened by the surgery. It appeared that the chondroma had been removed in its entirety. The pathological report was: "Very cellular chondroma. Areas of such active proliferation that this must be considered a chondrosarcoma; it is unlikely to give rise to distant

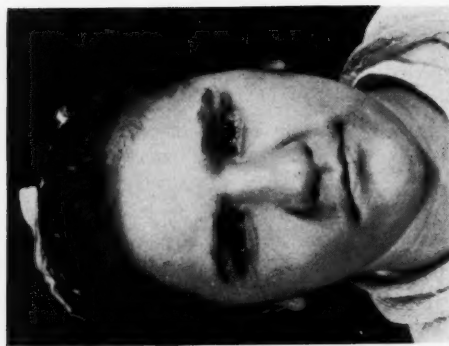


Fig. 1.

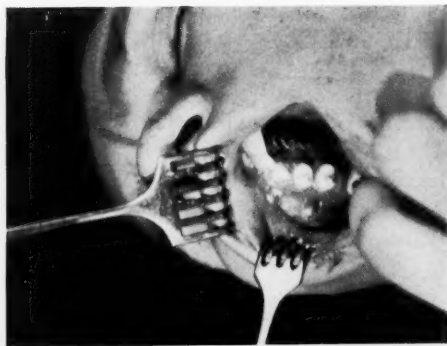


Fig. 2.



Fig. 3.

Figs. 1 and 2. The prominence low in the right cheek and the widening of the right upper alveolar ridge are shown.
Fig. 3. This photograph was taken on August 10th, 1936, three days before death.

metastases at this stage, but will continue to recur locally unless entirely removed." At the time of discharge from the hospital on April 7, 1936, there was considerable granulation tissue filling the antrum.

She returned April 13, 1936, with more granulation tissue in the antrum. Biopsy of the antrum contents was reported "Spindle cell chondrosarcoma; ulcerating surface covered with vascular pyogenic granulation tissue."

The patient was readmitted to the hospital on April 20, 1936, and the tumor had grown appreciably during the preceding week. She developed right lower and middle lobe pneumonia which appeared to be fusospirochaetal in etiology. Improvement in the chest condition was gradual, and the tumor continued to grow. On May 12, 1936, the tumor was shelled out of the antrum and the actual cautery used on all the exposed surface. Pain in the peripheral branches of the right fifth cranial nerve developed and became severe. The right gasserian ganglion was removed and reported negative by the pathologists on May 28, 1936. She was discharged in slightly improved condition on June 18, 1936.

She returned twelve days later because of rapid recurrence of the neoplasm, but was having much less pain. Four partial excisions were done with very rapid recurrence of the tumor. The rate of recurrence was such that the tumor obviously grew from day to day. She became cachectic, developed a widespread bronchopneumonia, and died August 13, 1936 (Fig. 3).

At postmortem examination an immense, globular, partially lobulated tumor mass, which was subcutaneous, occupied the entire right side of the face. It extended 11 centimeters to the right of the midline of the face, downward as far as the border of the mandible, upward three centimeters above the zygomatic process, closed the right eye entirely and raised the right side of the nose to the level of the bridge. Protruding from the mouth were several tufts of crusted neoplastic tissue, which was white, moderately firm, friable, and arose from the palate and alveolar ridge. The tumor filled the nasopharynx, had destroyed the anterior wall of the sphenoid sinuses, and had eroded the cribriform plate, exposing the dura. Microscopically, the neoplasm was a spindle cell fibrosarcoma. There was also a widespread bronchogenous and hematogenous lobular pneumonia.



Fig. 4.



Fig. 5.



Fig. 6.

Fig. 4. The patient when first seen on June 23rd, 1937.

Fig. 5. Condition of the boy on June 29th, 1938, when he was referred to the general surgery service for plastic procedures to close the fistula.

Fig. 6. The patient was discharged as hopeless with this huge recurrence on October 9th, 1938.

CASE 2.—E. S., a 15-year-old colored boy, first noticed swelling of the left cheek at the age of 13, but there was no progress in the swelling until May, 1937, during which month the rate of growth was great. There had been some soreness over the left antrum for six weeks and the left side of the nose had been obstructed for four weeks when the patient was first seen on June 23, 1937. The right side of the nose was open with some bloody crusting. The left side was closed by encroachment of the lateral wall of the nose. No pus was seen. The left upper alveolar ridge was moderately broadened. A large, non-tender, firm tumor, apparently arising from the anterior wall of the left antrum, extended up to the infra-orbital ridge and forward to the level of the bridge of the nose (Fig. 4). The left antrum was dark on transillumination. The neck, ears and nasopharynx were negative. By x-ray the left antrum was densely opaque. The bony lateral wall of the antrum appeared distorted and displaced laterally. The inferior orbital margin was very poorly defined and appeared elevated. Biopsy, done through the gingivo-labial fold on the left, was reported "Cellular fibroma with islands of persistent old bone at the margin; the neoplasm is not sufficiently cellular in this region to be considered sarcomatous, but there are occasional poorly differentiated cells which suggest that other portions of the tumor may be actually sarcomatous."

On July 2, 1937, the left antrum was opened. It was found that the tumor had eroded the mesial wall of the antrum, the roof, the posterior wall, the zygoma and the hard palate. It was felt that most, but not all, of the tumor was removed. Pathology reported "Material removed shows a neoplasm varying from a dense fibroma to a spindle cell osteochondrosarcoma. The areas which are more cellular will be distinctly invasive but are not apt to have given rise to metastases up to the present. If this recurs, it will undoubtedly be much more cellular and capable of giving rise to distant metastases." A week later 2400 milligram hours of radium irradiation were given by placing 100 milligrams of radium in the antrum. By August 6, 1937, he had received 3800 r from x-ray irradiation over a single port including the left cheek. He was discharged in good condition with a clean antrum.

The boy returned on September 4, 1937, complaining of pain in the left cheek. The alveolar process of the left maxilla was loose and the hard palate was perforated. The oral surgery service did a sequestrectomy of the left maxilla on September 14, 1937. Pathology reported a few nests of spindle cell osteo-chondrosarcoma in

the sequestrum. He was again discharged on September 24 with the antrum clean and without evidence of recurrence of neoplasm.

On October 19, 1937, the left cheek started to slough and one week later there was a seven centimeter defect in the cheek, so that one could look into nose, mouth and nasopharynx. There was no evidence of recurring neoplasm. When seen on March 18, 1938, the boy felt well, and there was no recurrence. Three months later there were no symptoms, there was no evidence of recurrence of neoplasm, and the patient was referred to general surgery for consideration of plastic procedures to close the fistula in the cheek (Fig. 5).

A Gillies tube was constructed from skin of the upper back. When seen on August 29, 1938, there was definite recurrence in the roof of the antrum. Two months later there was a tremendous increase in the size of the tumor and the left eye had been extruded onto the cheek. The eye was enucleated on October 2. It was felt that nothing further could be done and the patient was discharged as hopeless on October 9 (Fig. 6).

He returned on January 9, 1939, had partial excision of the sloughing neoplasm on January 14, and was discharged again on January 27. He died less than two months later in a Detroit hospital.

The chondroma of the superior maxilla and fibrochondroma of the antrum had their origin as benign neoplasms, but exhibited the characteristic of other connective tissue neoplasms of becoming malignant, and more so with each recurrence, so that eventually exceedingly rapid growth and a high degree of malignancy exist, as demonstrated in the first case. In view of the late serious nature of these neoplasms, one must not be misled by their early benign character.

607 MEDICO-DENTAL BUILDING.

LXII

SARCOIDOSIS OF THE EXTERNAL EAR

DAVID L. POE, M.D.

NEW YORK

This is a little known disease affecting the external ear. It is known to the medical profession as "sarcoid of Boeck." A diligent search of the literature failed to reveal a critical description of this involved ailment. The etiology is shrouded in darkness though the disease has been known for several decades. For a long time it was considered to be an affection of the skin only. Today, it is more fully recognized as a systemic ailment. Every organ in the body has been known to fall prey to its attacks. In the various descriptions of this disorder little has been said of the ear.

In 1899, Boeck made public his memorable studies of non-tender, firm, noncaseating nodules of varied sizes found in the skin; the name he applied was sarcoid, because, histologically, the tissue resembled the small cell sarcoma. Subsequently, a number of other observers published their cases. A variety of names was given to this disturbance. However, a critical sifting of the literature indicates a wide acceptance of this disease as a type of tuberculosis, the etiology of which is not known. The clinical changes which it apparently undergoes are also unknown.

Since the otologist, on account of his own meager personal experience, is usually dependent on the literature for guidance in the recognition of this unfortunate disease, I shall, therefore, report this case, which is under present observation, in detail. The paucity of reports is undoubtedly due to a lack of acquaintance with this condition.

REPORT OF A CASE

V. S., a dark-skinned, well-nourished negress, 38 years of age, was referred by the New York Skin and Cancer Unit to the Otolaryngological Department of the New York Post-Graduate Medical School and Hospital of Columbia University for examination because of hoarseness, and occasional shooting pain in the left ear. The patient stated that her hoarseness began about two years ago, and the pain in her ear shortly after.

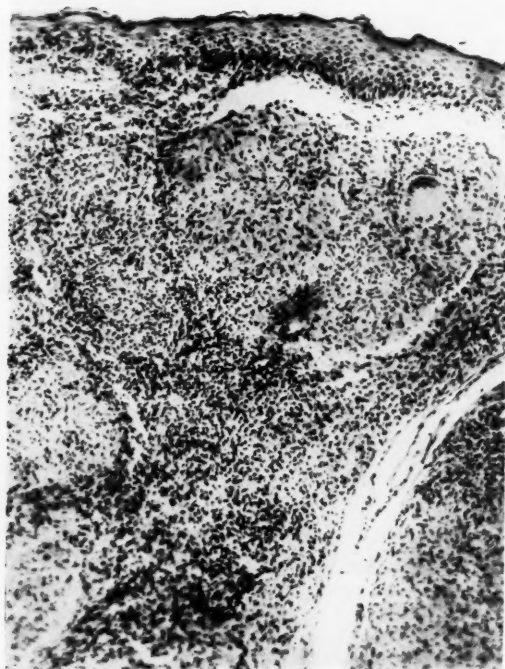


Fig. 1.

Examination revealed that in addition to the usual dermatological infiltrations of the face, nose and arms, characteristic of this affection, the skin of the external ear also showed marked changes. These changes consisted of miliary tubercles, which appeared to be in the early stages. They were raised, non-tender nodules about the size of a pin head. In some parts, the nodules were separated, while in other parts, the bases of several were very close together. These will, in all probability, coalesce in time to form a large raised plaque, as was seen in other portions of the body. The infiltrations were located in the skin, and any attempt to move the skin over the nodules failed. In no place was the surface of the nodule broken. When a biopsy was done, the skin having been removed with a scalpel, no evidences of infiltration could be seen or palpated beneath the cutis.

The patient stated that before the present illness her facial features were regular. At present her face is nodular and her nose is of the leper type. About eighteen years ago she first observed a number of small discolorations of the skin which disappeared. Three years afterward skin blotches reappeared, and although under almost constant medical care, she became progressively worse.

Her past history was negative. She did not know of any tuberculosis in her immediate family. She is married but had not lived with her husband for a number of years and had no children.

Her face, nose, arms, legs and fingers of both hands around the nails showed the characteristic nodules and plaques of Boeck sarcoid. The dermatological ailment consisted of cutaneous infiltrations which had a sharply defined border, were round or oval, ranged in size from a pin head to a plaque of 1 to 2 cm. in diameter, and in color were deep blue or violet. The infiltrations in the mucous membrane of the mouth and larynx were of a papillomatous nature. The trunk was unaffected. There were many places on the legs and arms showing regression where reduced pigmented atrophic spots or scars were located. Examining finger tips running across these spots gave the feel of a rubbery induration not much unlike the nodules and the plaques themselves.

The infiltrations in the ear were mostly located in the helix, anti-helix, scapha, fossa triangularis, the tragus, anti-tragus, and lobule of the auricle. The concha seemed to be free. Upon the helix, the nodules ran along the surface. They were not bunched together, but were scattered. The same was true of the anti-helix. Upon the lobule there were only about three, but one of the nodules was larger than the others found on the pinna. Upon the tragus the pin-head tubercles were closely packed and quite numerous. There were no infiltrations discernible in the auditory canal nor in the drum. The appearance of the surface of the drum and its details were within normal limits.

Hearing, as tested with audiometer, tuning forks, voice, etc., and vestibular tests, with cold water, were within normal limits.

Although there was a slight tremor in the right index finger, spontaneous past-pointing with right or left fingers when the arms were brought from various directions was absent. Spontaneous nystagmus was also absent.

Body temperature was normal. The wound produced by the removal of skin from the ear for laboratory examination healed readily and normally. There was no pain in the ear.

Repeated blood Wassermann tests were negative. Von Pirquet and old tuberculin tests were repeatedly negative.

A report from Dr. L. H. Meeker of the Pathological Laboratory of the New York Post-Graduate Medical School and Hospital of Columbia University is as follows:

Gross: There are three pieces of brown pigmented tissues up to 5 mm. in maximum diameter.

Microscopic: The sections have a covering of stratified squamous epithelium. At one point only a few layers of epithelium remain on the surface and this shows exfoliation. The underlying stroma contains numerous hair follicles and is marked by several oval areas of epithelioid cells which replace the connective tissue stroma. At the margin of these areas there is a small amount of lymphocytic infiltration. No giant cells associated with the tubercles are seen in the sections examined.

Diagnosis: Noncaseating tuberculosis or sarcoid.

Since this has become recognized as a constitutional disease it might be of interest to include the x-ray examination of the chest.

The x-ray findings of the chest are worthy of notation. They are as follows:

Examination of the thorax shows the total heart area relatively quite small and the transverse diameter fully $4\frac{1}{2}$ cm. below average, although otherwise of normal contour.

There are lymphomatous type masses along the tracheo-bronchial tract, the larger and more circumscribed of these about 4 cm. in diameter, protruding just above and to the right of the aortic arch. There is, however, further marked increase in density, again lymphomatous in type, at the hilus and root, with moderately secondary root branch and central bronchial thickening. The lesion is entirely central in origin and extent, with the peripheral lung fields comparatively clear.

Except for a moderate generalized vascularity, there is no evidence of recent parenchymatous infiltrations or pleural involvement.

The alae of the nose show numerous small protruding nodules, extending from the outside around the lower borders into the skin of the interior up to but not involving the mucosa. The skin of the anterior inferior nasal spine is also involved. Nowhere are the nodules broken down.

While this paper is intended to serve as a report of Boeck sarcoid of the external ear, the writer included reference to the appearance of other parts of the body in order to present a more complete clinical picture to the otologist to facilitate recognition of this complicated ailment.

While the diagnosis of this disease has become reasonably well standardized, there is as yet no therapy than can be offered the unfortunate victim.

SUMMARY

So far as the writer has been able to ascertain, this is the first complete description of Boeck sarcoid of the external ear. To make it of practical value to the otologist, short dermatological descriptions of infiltrations of other areas are also given.

The x-ray findings of the chest might serve as additional evidence that the disease is of a generalized nature. Nowhere is ulceration of the ear present.

745 FIFTH AVENUE.

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The Scientific Papers of the American Broncho-Esophagological Association

LXIII

THE PRESIDENT'S ADDRESS*

LYMAN G. RICHARDS, M.D.

BOSTON

Customary platitudes of acceptance of the high honor which you have conferred upon me in electing me to the presidency of this Society seem quite inadequate in voicing my profound appreciation.

Sincerely recognizing the greater merit of many of those before me, I can only say that without the stimulus of this Society and the constant and friendly help of many of its members, the little progress I have made along the bronchoscopic road would have been impossible.

It is now fifteen years since I attached a vise and rubber tube to the bed-post and made my first attempts at removing a collar button from this artificial bronchus. It is a paradox that the foreign body on which I spent my most zealous efforts in manikin practice has not as yet crossed my clinical path.

It is well perhaps that we do not see what lies ahead of us as we begin the practice of broncho-esophagology. Inevitable failures might be discouraging, while no preview of successes could equal the immeasurable satisfaction that comes with the surmounting of difficulties and the slow mastery of technique. Only by individual effort and application of such talent as one possesses can progress be made toward the example set before us by our illustrious predecessors.

My personal endoscopic experience, as measured by that of many of you, has been limited. Nevertheless, I venture to think that within a decade and a half I have committed errors which, though

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avoidable in retrospect, have taught me lessons to be learned in no other and easier manner. With the thought that members still younger than myself may profit by some reflections on the training of the peroral endoscopist, I am moved to set down a few precepts which, in the light of my own experience, I would have found profitable.

I am the more minded to do this because I feel that, like myself, many otolaryngologists find themselves spending only a portion of their time in this special field and hence devoting to it less concentrated attention than the rarer endoscopist who can subordinate all other branches of his work to peroral endoscopy. Undoubtedly the time will come when the number of men devoting themselves entirely to broncho-esophagology will be far greater than at present. For the moment this otherwise ideal situation is thwarted by the very fact that more and more otolaryngologists, with, and I fear sometimes without, adequate special training, are adding this field to their routine preserves. On a purely altruistic basis, patients requiring the services of an expert endoscopist who has declared himself as working only in this field should be referred to him by his less experienced confreres. In certain cities this ideal is already an accomplished fact. In many places, however, consultants are still selected for reasons other than their known endoscopic ability, and experience and surgical judgment are thus dispersed among a group of which no single member advances to a degree of proficiency which would ideally be possible, were all the endoscopic work concentrated in the hands of the pure endoscopist.

I also imagine that like myself many of the younger men must still carry out their work in general hospitals in which the endoscopic department is only a small unit of the surgical service and as such may find itself relegated to a position requiring vigorous and persistent assertion in order to secure recognition. This situation oftentimes reflects itself not only in restrictions in equipment but, equally important, in the necessity of accepting nursing and orderly assistance from a constantly changing personnel, thwarting the best laid plans to organize that ideal of all bronchologists, a reasonably stable "team". A capable and understanding instrument-passer is no sooner well trained for the tense moments of the removal of a foreign body than she is suddenly replaced by a conscientious but inexperienced successor who must forthwith be taught the difference between a bronchoscope and an esophagoscope. Still more disconcerting is the frequent necessity of carrying out endoscopic work in several different institutions, which requires the laborious transpor-

tation of instruments and equipment lacking in so many institutions where bronchoscopic examination is a surgical novelty. In this connection, I would caution the young bronchologist against the inevitable temptation to yield to requests to travel about far beyond his normal base of activities at the request of neighboring consultants who either fear or dislike to send patients where they can be cared for most efficiently. Such itinerant accommodation of the local physician's convenience will be likely to be provocative of bitter disappointment to the bronchologist. Essential equipment in the local hospital will almost certainly be found missing at a crucial moment, necessary and adequately trained assistants will be supplanted by someone thrust into the breach at the last moment, and the operator will find himself working under adverse conditions which can only lead to embarrassment if not to complete failure. The fear that refusal to accede to the request thus to travel about will result in the loss of the patient can be confidently set aside. Seldom will tactful insistence that a patient be transferred to the place most likely to assure a successful outcome be flatly disregarded. Few indeed are the occasions when a candidate for bronchoscopic therapy cannot be safely transported, and the rapid advance in air travel is steadily reducing the possible risk involved in such a journey.

The gospel of bronchoscopy, so ably preached by the illustrious pioneers in this field, is daily spreading more and more widely throughout the country. The advisability of foreign body removal by endoscopic methods is universally accepted. It is well known, however, that this branch forms a steadily decreasing proportion of our work and that bronchoscopic diagnosis and therapeutics should constitute an adjunct to the medical and surgical services in any hospital. Nevertheless, the bronchoscopic novice organizing his department may be surprised to encounter some scepticism on the part of his medical and surgical confreres, either as to the value of such endoscopic assistance or to the risks and possible complications which may attend it. Some internists and surgeons today retain in their minds the image of a bronchoscopic examination as a torturing ordeal for the patient, more particularly if first-hand observation of modern bronchoscopic technique has never been utilized. In the face of such prejudice, the acceptance of bronchoscopy as a valuable adjunct in the hospital service will best be achieved by rigid attention to all details which go to make the operation of minimum discomfort and maximum safety and, if possible, by showing on every occasion the value of the data and the merits of therapy accruing from bronchoscopic diagnosis and treatment. Such efforts will most

certainly be met by an increased reference of patients to the bronchoscopic service until it becomes an indispensable and integral part of the organization.

Achievement of success in the execution of bronchoscopic maneuvers rests on many foundations. Some men are by nature more manually dextrous, more endowed with keen vision than others. These talents will be supplemented or nullified to a large degree by the foresight and perspective with which they are exercised. It has been a personal experience that an instinctive tendency to attack a bronchoscopic problem before every possible eventuality has been foreseen and planned for may convert an easily mastered situation into a dilemma. Assurance that all equipment is in perfect order, that all possible preliminary aids have been utilized and that the desire for a successful outcome is subordinated to attention to detail will often be more important than technical operative skill. In foreign body work in particular untold advantages accrue from preliminary study and practice with the manikin, from investigation of a similar problem as encountered by others and from refusal to accede to the feeling that a makeshift instrument or omissions of some apparently dispensable laboratory aid will not jeopardize the situation. Willingness to postpone attempts at removal until an ideally suitable forcep can be secured, until a duplicate foreign body can be obtained or until necessary if repetitious x-rays can be taken will frequently spell the difference between success and failure.

Most difficult of all, in my own experience, has been the resistance of the temptation, with a foreign body in sight through the tube, to grasp it and attempt its removal before ideal conditions for success had been achieved. Removal of impeding secretions, assurance of maximum forcep spaces and advantageous presentations must be uppermost in one's mind, no matter how tempting the thought of a spectacular display of endoscopic skill. With each failure and with each succeeding attempt, the prospects of success grow dim. Far wiser is a thorough preliminary survey of the problem in hand and the decision to postpone removal till some important obstacle can be overcome, than reliance on the hope that good fortune rather than good judgment will prevail. A secondary bronchoscopy, if no damage has been occasioned by the first, will often prove surprisingly successful. Thus to put one's pride in one's pocket may not impress the bystanders but will prove of untold benefit to the patient. How frequently we see a patient referred for bronchoscopic removal of a foreign body whose physician has as-

sured him this will be a simple procedure and that he will be able to leave the hospital the same day.

Constant though oftentimes inconvenient availability will go far toward enhancing the young bronchoscopist's reputation. One of our most distinguished members once said that the outstanding clinical opportunities come on Sundays and holidays. Until one reaches the stage of periodic reliance on a competent assistant, the telephone must be almost within arm's reach. The frequently accidental nature of a bronchoscopic problem often makes such cases clinical and, though far less often than many men believe, surgical emergencies.

The increase in the number of well trained endoscopists, while unquestionably beneficial in respect to service rendered to the public, inevitably necessitates a subdivision of work to the end that each individual's experience is curtailed. To supplement this lack, particularly for the beginner in bronchoscopy, it is highly important that he maintain the education of his eye and his fingers by some form of laboratory practice, best achieved by the humane use of suitable animals. The temptation, after a zealous beginning, to drop this activity as other demands crowd in upon one's time, is a strong one. Its maintenance should, however, be an inflexible rule, and the benefits in superior technique which result from such a policy will be gratifyingly evident in the operating room. Personally I have found a monkey to supply the nearest approach to the endoscopic problems encountered in the patient, and the fortunate opportunity of working in a surgical laboratory with such facilities has been of inestimable assistance to me.

The present availability of specialized postgraduate courses in bronchoscopy would seem to make imperative the best possible preparation in this field before undertaking any clinical work. To gravitate into this specialty with no better training than that incident to general otolaryngology and self-instruction from the textbooks should be as outmoded as the transition from general practice to a specialty without a specialized internship. The assumption, still prevalent among general practitioners, that bronchoscopy is inherently the field of any otolaryngologist, whose clinical opportunities may demand of him only an occasional passage of a bronchoscope, must give way to the recognition that this work is far safer in the hands of men whose training and experience justify their undertaking it. I can visualize the development of short postgraduate internships in bronchoscopy in our otolaryngological hospitals.

More recently there has appeared upon the broncho-esophagological horizon a new star in the form of what may be termed the endoscopic internist and endoscopic surgeon. With the increased value of bronchoscopy to the thoracic surgeon and to the specialist in pulmonary disease, many of these men are including bronchoscopy as part of their own diagnostic equipment. For this I can see much justification and cannot bring myself to the view that none but a trained laryngologist should even look down a bronchoscope. I can appreciate that a thoracic surgeon might well desire to see personally the location of a bronchial tumor before undertaking lobectomy and that thorough conversance with the patient as a medical problem would add much effectiveness to any bronchoscopic report. It is true that many thoracic surgeons and internists have at their right hand a laryngologically-trained endoscopist, but unless the two fields are intimately associated, the surgeon or internist is likely to be dissatisfied with the report of a laryngologist whose only contribution to the problem is a report of his bronchoscopic observation totally unsupported by knowledge of the detailed physical findings or the special requirements of the thoracic surgeon. The situation is in many ways analogous to that of the genito-urinary surgeon who considers cystoscopy as anatomically a part of his specialty, for which he would scarcely consider calling on the laryngologist for help.

It must, I think, be conceded that such a thoracic surgeon or internist can, with adequate special training, master the mechanics of passing a bronchoscope or esophagoscope and may even go further and combine these procedures with gastroscopy and peritoneoscopy, fields into which the laryngologically-trained bronchoscopist is frequently disinclined to treat.

Granted that such medically or surgically trained peroral endoscopists are more and more coming to the fore, it becomes a perplexing problem as to where certain bronchoscopic problems are to find a resting place. Shall removal of a tracheal foreign body be attempted by a laryngologist whose infrequent bronchoscopic experience may not have led him into the trachea for three months or more, or by the medical endoscopist who in the past week has performed a dozen bronchoscopies? This I conceive to be a most pertinent question and one which, if I read the endoscopic horoscope aright, is destined to become more rather than less important as time goes on.

I am still convinced that the endoscopist with laryngeal training is far better equipped to deal with laryngeal obstruction and the

possible tracheotomy which may follow too vigorous bronchoscopy. The overlapping of such specialized fields is one of the products of modern medical progress and is not a problem restricted to the upper air and food passages.

More specifically I am somewhat concerned with the provision now made for such surgical and medical endoscopists by this Society. Even in the revised constitution they are classified as associate members and as such have no vote in the Society's proceedings, despite the fact that they may be confining their work almost entirely to endoscopy and in a volume ratio of 10 to 1 in comparison with many a laryngological endoscopist. Unquestionably laryngology was the sire of bronchoscopy, but in line with other alterations in medical practice there are indications that another and in some ways equally legitimate parentage is calling for recognition. The problem does not admit of any immediate solution, but I feel that the budding bronchoscopist entering the field through the conventional doorway of laryngology must be prepared to encounter competition from a direction which until recent years was considered not only unlikely but unreasonable.

That my personal endoscopic experience has been far more limited than many of you here this morning, I have already admitted. My failures have been to a large degree the result of neglect of some of the principles which I have just enumerated. The successes have come from efforts to follow the precepts so clearly laid down by many of my predecessors and teachers. I have recounted some of the lessons I have learned in the hope that the younger men entering upon work in this field may thereby be spared the disappointments which may follow in the wake of neglect of some of the maxims I have mentioned.

For the stimulation and encouragement which this Society and many of its members have brought to me, I am profoundly grateful. To younger men in particular, attendance at its meetings and contributions to its programs will prove equally valuable.

Friendly criticism and stimulating encouragement are fundamental to the progress which broncho-esophagology has made and will continue to make as time goes on.

319 LONGWOOD AVE.

LXIV

NON-FOGGING SPECTACLES FOR BRONCHOSCOPY*

ARTHUR Q. PENTA, M.D.

SCHENECTADY

It is with some degree of reluctance that I present before this society this simple invention, designed to do away with spectacles becoming fogged during bronchoscopic examination.

A factor of major annoyance in bronchoscopic work is the blurring of the visual field caused by the accumulation of moisture on the lenses during the examination. The seriousness of this situation at times is most embarrassing, as, for example, when about to



Fig. 1. Non-fogging spectacles.

make forceps application to a foreign body or to do a biopsy, one suddenly realizes that the endobronchial area from which it is desired to remove the tissue has become blurred in the visual field (Fig. 1).

*Read before the twenty-third annual meeting of the American Broncho-Esophagological Association, New York, N. Y., June 5, 1940.

The glasses as shown in Fig. 1 consist of two pairs of optically flat lenses, having a small resistance coil interposed between them. The edges of the lenses are then cemented, and the ends of the coils are brought out through two small openings which have been drilled about one-eighth of an inch from the edge of the lenses. The terminals from each coil are insulated by means of bakelite to the nasal bridge of the glasses. The terminals are then connected by leads to an ordinary bell transformer.

The heat generated on the lenses by the resistance coil is barely perceptible and yet sufficient to prevent condensation. Several of these glasses may be kept in a warm box having a 60-watt lamp, so that in the event that thick mucopurulent secretions gather on the lenses, the glasses can be immediately changed, and no time is lost in heating above the dew point. Ordinarily, it takes two to three minutes for the glasses to be sufficiently heated.

These glasses may be worn over other glasses, or, if it is desired, they can be specially made up with lenses of any correction.

713 UNION ST.

THE SURGICAL TREATMENT OF INTRACTABLE
CARDIOSPASM: A REPORT OF TWO CASES*

CLYDE A. HEATLY, M.D.

ROCHESTER

Universal experience indicates that repeated controlled dilatation of the hiatal esophagus over a variable period is the treatment of choice in that complex group of disorders known as cardiospasm. It is also well established that in certain cases resistant to this type of treatment, a careful search for lesions in the gastrointestinal tract or abdominal viscera may discover a reflex cause for the continued difficulty, the correction of which favorably influences the dysphagia. There remains, however, in the experience of most observers a small group of intractable cases which resist all therapeutic efforts. In many of these instances the esophagus has become twisted in S-shaped fashion so that the lowest turn is actually well below the level of the diaphragmatic hiatus. Here, as Bird¹ has so aptly stated, "the secondary mechanical factors, distortion and gravity, far outstrip the original achalasia as elements of importance in the obstruction" and "any treatment which fails to take them into consideration is futile." The continued miserable existence of these patients is so completely intolerable that the possibilities of surgical relief warrant careful consideration. The hazards of dilatation in long-existing cases in the form of extremely thin walls and goose-neck twistings of the terminal esophagus give additional importance to this approach. It is fully realized that the technical surgical problems involved are not within the field of our own specialty. The decision to employ surgery, however, so frequently rests with us that a consideration of this subject seems in the opinion of the writer to be of value.

The surgical treatment of cardiospasm was first attempted in 1904 by Mikulicz, who reported a number of successful results from opening the stomach and digitally stretching the cardiac orifice until a specially devised forceps could be inserted for securing wide dila-

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tation. Bonsdorff in 1906 reported favorably on this method, and later (1918) Lindstrom described a modification by invagination of the gastric wall into the cardia without preliminary gastrotomy. Heller in 1913 described the so-called extramucous cardioplasty which employed the muscle-splitting procedure of the Rammstedt operation for hypertrophic pyloric stenosis. The esophagus was loosened from the hiatus, drawn downward and two longitudinal incisions made into the submucosa, one on the anterior and the other on the posterior wall of the esophagus. Serious or fatal infection occasionally resulted from penetration through the esophageal mucosa. At the German congress in 1921, however, Heller reported on 21 operations with 17 good results and no mortalities. A modification of this method, following the principles of the Heineke-Mikulicz operation for pyloroplasty was introduced by Wendel (1910) and followed by several other surgeons. The longitudinal incision was carried through all the layers of the esophagus and then re-sutured in a transverse direction. Heyrovsky in 1910 performed the first esophagogastrostomy. The esophagus was loosened from its attachments at the hiatus, drawn downward 6 to 8 centimeters, fixed in its new position, and anastomosed with the fundus of the stomach in the manner of the well-known Finney pyloroplasty. Bull² in 1925 reported on the results of four of his own cases and twelve of other European surgeons operated upon by this technique. There were one death and one unsatisfactory result; otherwise the "results were good and in the majority entirely ideal and lasting." The English surgeon Turner³ in 1931 also reported favorable results with this type of lateral anastomosis as did Churchill⁴ in 1935 (2 cases) and Womack⁵ in 1938 (2 cases). A radically different approach to this problem was suggested in 1934 by Craig, Moersch and Vinson⁶ who reported a good immediate result in one case by bilateral cervicothoracic sympathetic ganglionectomy. Wright and Adamson, as the result of animal experimentation, expressed the belief that denervation by excising the left gastric artery and the adjacent omental tissues should destroy the sympathetic control of the cardia and benefit achalasia. Eight patients were reported by Turner and Knight⁷ in 1936 managed by this procedure with indifferent results. Souttar⁸ reported two patients and Stubbe⁹ one case benefited by this operation. The anatomical studies of Woollard¹⁰ and Mitchell,¹¹ however, indicate a three-fold widespread sympathetic supply to the cardia, so that the possibilities of complete surgical denervation appear unlikely. Furthermore, the secondary fibrotic changes and mechanical problems seen in advanced cases seem unfavorable to this type of solution.

During the past year the writer has encountered two cases of cardiospasm which were found to be intractable to ordinary methods of treatment. The problem was discussed with Dr. J. W. Merle Scott of the Department of Surgery and a decision made to employ a lateral anastomosis between the lower esophagus and the cardiac portion of the stomach in the manner of the Finney pyloroplasty. The results in Dr. Scott's hands proved so satisfactory that an effort to secure wider recognition of this procedure in hazardous or intractable cases seems pertinent.

OPERATIVE PROCEDURE

The important steps in the gastroesophagostomy performed by Dr. Scott follow the method introduced by Heyrovsky and successfully used by Bull, Turner, Churchill, and Womack. He summarizes the procedure as follows:

"The abdomen is opened through a left paramedian incision extending up into the angle between the ensiform cartilage and the costal margin, care being taken not to go through the attachment of the diaphragm at this point. The left lobe of the liver is then held downward and the left triangular ligament is divided. Following this the left lobe of the liver can be retracted below the right abdominal wall, fully exposing the cardiac end of the stomach, the abdominal part of the esophagus, the esophageal hiatus and the contiguous areas of the diaphragm. A tape is passed around the esophagus in the region of the cardia, care being taken not to injure the esophageal branches of the left gastric vessels. Traction downward on the tape facilitates the next steps in the operation. The peritoneal reflection coming down from the diaphragm on to the esophagus is divided at the esophageal hiatus, and the esophagus is entirely detached from its cellular bed as it passes through the diaphragm. By blunt finger dissection the esophagus in the posterior mediastinum is freed, and this lower end of the thoracic esophagus is then pulled downward into the abdomen from the traction of the tape. At least the last two inches of the thoracic esophagus can in this way be brought down into the abdomen. This brings the lower part of the esophageal dilatation below the diaphragm. The diaphragm is then carefully reattached to the upper end of the mobilized esophagus so that the mediastinum is again completely walled off from the abdominal cavity. The fundic portion of the stomach rising above the cardia is then easily brought over without tension and attached to the left border of the lengthened abdominal esophagus, traction on the tape being maintained to hold the parts down within easy

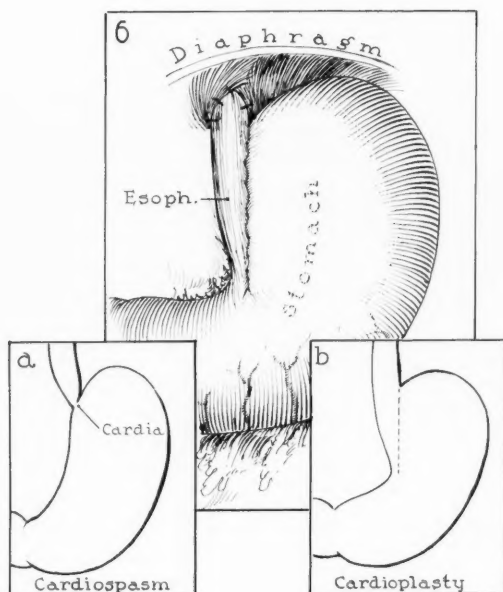


Fig. 1.

reach during the first stages of the anastomosis. The esophagus is temporarily blocked with a clamped soft rubber tube and the cavity of the stomach with a rubber-shod clamp. Then anterior to the completed outer layer of the posterior suture line a U-shaped incision is made, the left vertical segment of which passes through the stomach; the lower curve divides the cardia, and the right vertical segment extends up the esophagus. All layers of the contiguous posterior gastric and esophageal walls are then united by a suture completing the posterior row. This suture is carried around the upper end of the incision where the anterior walls of the stomach and esophagus are united also including all layers. The anastomosis is then completed by putting in a second anterior row of sutures covering the first. Care is taken to protect the upper angle of the anastomosis by one or more interrupted sutures between the stomach and esophagus and also by a suture between the stomach and the peritoneum along the left side of the esophageal hiatus. This pro-

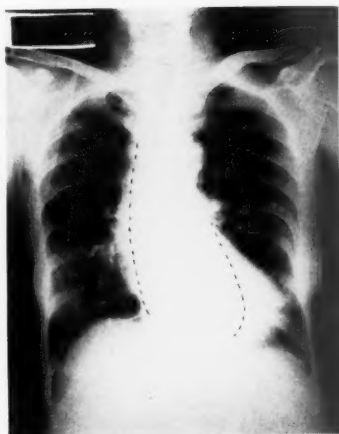


Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.

cedure makes a wide opening between the stomach and the lengthened abdominal esophageal segment and provides a direct opening from the dilated part of the esophagus into the stomach (Fig. 1). No drainage is required if care is taken in the security of the suture line. The left lobe of the liver is returned to its position by one or two sutures, reconstructing the outer edge of the left triangular ligament."

CASE REPORTS

CASE 1.—E. P., a 79-year-old woman, was admitted to the Strong Memorial Hospital on May 25, 1939, complaining of dysphagia, vomiting and loss of weight. In January she had contracted a severe respiratory infection and during convalescence had noticed substernal distress and increasing difficulty in swallowing. Further inquiries indicated that seven or eight years before she had her first period of dysphagia and that attacks had occurred intermittently until two years before, since which time her trouble had become more and more constant. During the three months preceding her admission her diet had been reduced largely to liquids and she had lost over 20 pounds in weight. It is of interest to note that her gall bladder had been removed 15 years before.

X-ray studies (Fig. 2) showed the typical findings of cardiospasm with wide dilatation and some tortuosity of the lower esophagus. Spinal anesthesia was carried out in order to determine the effects of paralysis of the sympathetic nerve supply. Fluoroscopic studies indicated no resulting relaxation of the obstruction. Direct examination of the esophagus revealed the typical findings of well-established cardiospasm. The stomach could be easily entered. Several pneumatic dilatations were given under fluoroscopic control without appreciable relief. Although the patient's advanced age seemed to contra-indicate anything except the most conservative type of treatment, she firmly insisted that she would rather risk a surgical procedure than continue under existing circumstances. On June 27, therefore, a gastroesophagostomy was performed by Dr. Scott under general anesthesia. The postoperative recovery was uneventful. The patient has been followed carefully since operation and has been taking a regular mixed diet without difficulty (Fig. 3). She has regained her weight loss and feels well.

CASE 2.—F. S., a young woman of 25, was admitted to the Strong Memorial Hospital on September 29, 1938, complaining of severe dysphagia which had first been noticed seven months before.

She had already received numerous dilatations in another city without benefit except for a few days. Her diet had been reduced to liquids, and in spite of this there was daily regurgitation. She had lost about 25 pounds and was very weak and nervous.

The general physical examination was negative except for evidence of weight loss and secondary anemia. X-ray studies (Fig. 4) showed a widely dilated esophagus with typical smooth obstruction at diaphragmatic level. Direct esophagoscopy confirmed the clinical diagnosis of well-established cardiospasm. A series of pneumatic dilatations were carried out over the next few months. Each time the patient experienced transient relief for a few days only. On March 6, 1939, it was decided to proceed with gastroesophagotomy because of the complete failure of dilatation treatment. A Levine tube was kept in place for seven days. The patient was discharged from the hospital on March 25 after an uneventful convalescence. She has been followed regularly since that time, has regained her weight loss and has been able to eat a mixed diet without difficulty or regurgitation (Fig. 5).

SUMMARY

The possibilities of surgical relief for intractable cardiospasm are illustrated in the two cases reported. A review of the literature as well as the experience gained in these cases suggests a lateral anastomosis between the lower esophagus and the cardiac portion of the stomach in the manner of the Finney pyloroplasty as the surgical procedure of choice in these instances. It is hoped that this presentation will direct wider attention among endoscopists to the possibilities of surgical assistance in these cases which resist our usual methods of treatment.

11 N. GOODMAN ST.

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TUBERCULOUS PERIESOPHAGEAL ABSCESS PRODUCING
STENOSIS: REPORT OF A CASE*

LOUIS H. CLERF, M.D.

PHILADELPHIA

Primary tuberculous infection of the esophageal wall is rare. It usually is involved secondarily in extension of a tuberculous process in mediastinal lymph nodes, bronchi or lungs. Adhesion of a tuberculous lymph node to the esophageal wall is not uncommon and probably is an etiological factor in traction diverticulum.

The following case is of interest because of the abrupt onset with progressive dysphagia and pain, the presence of tubercle bacilli in pus secured from the abscess in the absence of any demonstrable tuberculous lesion elsewhere, prompt recovery after evacuation of the collection of pus and no recurrence of symptoms nor development of tuberculosis in other organs or structures.

REPORT OF A CASE

A male, aged 22 years, a seminarian, was admitted to the Germantown Hospital by Dr. F. P. Massanisco for investigation of pain in the back and painful and difficult swallowing.

The personal medical history was negative except for pneumonia at the age of seven years. The present illness had begun ten days previously with pain in the chest to the right of the thoracic spine corresponding to the fifth and sixth vertebrae. Although the pain was made worse with deep breathing there was no clinical evidence of pleurisy. There was slight fever. On the fifth day there was noted dysphagia which became progressively worse and was associated with pain.

When admitted on April 6, 1939, there was dysphagia for liquids as well as solid foods, and any attempt to swallow was associated with severe pain. This was limited to the back in the region of the midthoracic spine and beneath the upper one-half of the

*Read before the twenty-third annual meeting of the American Broncho-Esophagological Association, New York, N. Y., June 5, 1940.



Fig. 1. Roentgenograms made after swallowing a thick barium mixture and a barium-filled capsule revealed displacement of the esophagus anteriorly and to the left with marked narrowing of the esophageal lumen. The obstructing mass is uniformly dense and exhibited no fluid level. (Films by Dr. T. P. Loughery.)

sternum; it did not radiate. Examination of the heart and lungs was essentially negative. There was an absence of respiratory symptoms. There were no points of tenderness over the spine or ribs. Blood studies were normal except for a leukocytosis of 10,200. The Wassermann test of the blood was negative.

A roentgen study of the chest by Dr. Thomas P. Loughery revealed an increase in the hilum shadows and pulmonary markings. The heart shadow appeared normal. There was slight widening of the mediastinum to the left at the level of the aortic arch. A functional study of the esophagus revealed displacement of the esophageal lumen to the left and anteriorly. Thin barium mixture passed around a more or less rounded symmetrical prominence, 4 to 5 cm. in length, beginning at the level of the third left costal cartilage. A thick barium mixture passed with great difficulty and a No. 0 barium-filled capsule lodged (Fig. 1). Although in close proximity to the aortic arch there was no abnormal pulsatory movement noted, and the aorta could be visualized and did not appear to be a part of the obstructing lesion.

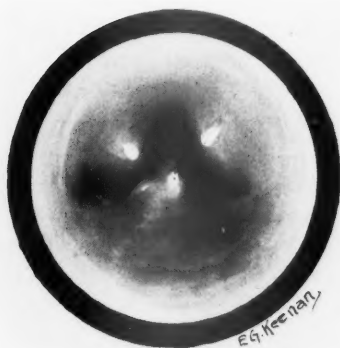


Fig. 2. Drawing of esophagoscopy view shows bulging forward of posterior esophageal wall with small pointed area which was opened with forceps evacuating a large quantity of pus.

At esophagoscopy there was found marked narrowing of the lumen of the thoracic esophagus at a point corresponding to the level of the aortic arch. The esophagus was found displaced to the left and anteriorly by a crowding inward of the right lateral and posterior walls. The mucosa overlying this appeared inflamed and at its most prominent point presented a yellow bleb-like elevation (Fig. 2). The entire area appeared soft and could be displaced with the tip of the esophagoscope, suggesting that the compressive lesion either was of inflammatory or cystic origin. Removal of the yellowish bleb with forward grasping forceps was promptly followed by a gush of thin yellow pus. About 30 cc. of pus were secured in a collector, and an additional quantity flowed downward beyond the point of stenosis and was not recovered. Several small fragments of tissue about the opening of the abscess also were secured for study. The esophagoscopic diagnosis was abscess of the esophagus of unknown etiology. Although there was no history of foreign body it was believed at this time that the abscess was of pyogenic origin and that the infecting agent had entered through a break in the esophageal mucosa secondary to trauma.

Bacteriological study of the pus by Dr. Frank B. Lynch revealed many tubercle bacilli as well as a few pneumococci and streptococci. The tissue consisted of necrotic material and a few connective tissue elements which exhibited inflammatory changes.

The patient was relieved promptly of painful and difficult swallowing, and the temperature and leukocyte count returned to normal. Subsequent studies of the esophagus revealed no abnormality. Additional studies of the lungs failed to show any evidence of a tuberculous infection. A study of the thoracic spine was negative.

The patient was discharged from the hospital within one week. He soon returned to his usual occupation and has been well since. A roentgen study of the swallowing function made on May 23, 1940 by Dr. Thomas P. Loughery revealed no evidence of narrowing, deformity or distortion of the esophagus. There are no symptoms referable to swallowing.

Comment: In the absence of any demonstrable evidences of tuberculosis elsewhere at the time when tubercle bacilli were found in an abscess communicating with the esophagus and with additional negative roentgen and clinical findings following recovery, one may assume that the tuberculous lesion was primary, presumably in a mediastinal lymph node. It was not deemed advisable to explore the abscess cavity at the initial esophagoscopy nor did it seem desirable to remove additional tissue from the abscess wall for histological examination. For this reason the diagnosis of tuberculosis and the presence of the disease in a periesophageal lymph node cannot be supported by histological evidence. It appears probable that the tuberculous infection was quiescent in a lymph node which became secondarily infected by pyogenic bacteria through the esophageal wall.

1530 LOCUST STREET.

LXVII

ULCERATION OF TUBERCULOUS HILAR LYMPH NODE
INTO LUMEN OF BRONCHUS, WITH BRONCHO-
SCOPIC REMOVAL: REPORT OF A CASE*

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AND

W. E. PEMBLETON, M.D.

RICHMOND

Direct visualization of the tracheobronchial tree has made possible recognition of unusual types of tuberculosis involving the respiratory tract which previously were not identified, even at postmortem examination. Bronchi can be examined more satisfactorily during life with a bronchoscope than by dissection at postmortem examination. The more frequent diagnosis, therefore, of tuberculosis of the trachea and bronchi has resulted undoubtedly from more general employment of the bronchoscope in diseases of the respiratory tract, rather than from actual increase in incidence of tracheobronchial tuberculosis.

Several types of tuberculosis of the trachea and bronchi have been observed, varying from superficial ulceration without reduction in the lumen of the air passages to dense, partly or almost completely healed, bronchial strictures. Extensive tuberculomas have also been observed, as well as compression of bronchi from extra-bronchial lymphatic nodes which have become enlarged as the result of tuberculous disease. Healing of tuberculous peribronchial lymphatic nodes with complete replacement of glandular tissue by deposits of calcium has given rise to secondary pulmonary disease when nodes of this type ulcerate through the wall of a bronchus and enter the bronchial lumen. Many of these so-called "lung stones" have been encountered at bronchoscopic examination, and their removal has been followed by the same beneficial result that occurs after removal of a foreign body aspirated through the mouth.

Ulceration into the lumen of a bronchus of an actively diseased tuberculous gland with little or no calcification is seldom ob-

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Fig. 1.



Fig. 2.

Fig. 1. Infiltration at base of right lung, resembling carcinoma.

Fig. 2. Marked resolution of infiltration after removal of tumor from lumen of bronchus.

served, and because of the rarity of this type of disorder the following case is reported.

CASE.—W. E. H., male, 63 years of age, was admitted to Memorial Hospital September 9, 1939, because of severe pulmonary hemorrhage. He had been well until six months previously, when he had had a cerebral hemorrhage with partial right hemiplegia. Improvement was rapid, and within a month he was able to return to his work as a machinist.

He was then well until two weeks before admission to hospital when a hacking cough, productive of a small amount of grayish mucus, developed. After a week, streaks of blood were noted in the sputum, which culminated in a copious hemorrhage on the day of admission. There had been no pain, wheezing, fever, or dyspnea. The patient thought the bleeding came from the right lung.

The blood pressure was 210 systolic and 170 diastolic, with a pulse rate of 68 and respirations numbering 28 per minute. Except for poor teeth, physical abnormalities were limited to the thorax. The lungs were emphysematous, and the percussion note was not

impaired over any area. Breath sounds were absent over the base of the right lung posteriorly and in the right axillary region.

Blood studies revealed a hemoglobin of 80 per cent, 3,690,000 erythrocytes and 7,400 leukocytes, with a normal blood smear. Bleeding continued for two days after admission to hospital, and the hemoglobin dropped to 64 per cent and the erythrocytes to 3,360,000. Other laboratory studies were normal, and four examinations of the sputum failed to reveal bacilli of tuberculosis.

Roentgenoscopic study of the thorax by Dr. Fred B. Mandeville was reported as follows: " * * * prominent trunk markings in the region above and to the right of the right cardiophrenic angle, suggesting bronchiectasis. The possibility of neoplasm was considered likely. There were several healed tuberculous foci and moderate pulmonary emphysema" (Fig. 1).

Fever ranged from 99 to 103 degrees. In addition to distant breathing at the base of the right lung, increasing impairment of percussion note was noted over this area.

On September 20, 1939, bronchoscopic examination revealed a tumor occluding the bronchus to the lower lobe of the right lung. It was firm in consistency and appeared to be malignant. When forceps were applied for removal of tissue for microscopic study, the portion removed was too large to be brought through the extension tube of the adult size Bruening's bronchoscope. The tissue was released from the forceps and the extension tube of the bronchoscope was withdrawn. Following this procedure a large piece of tissue was spontaneously expelled through the bronchoscope.

The extension tube was then reinserted, and it was found that an area of ulceration on the lateral wall of the bronchus represented the site of the tumor that had been removed. Small fragments of tissue were removed from this area for microscopic examination. The lumen of the bronchus had been completely restored by removal of the tumor. Microscopic study of the tissue removed from the wall of the bronchus revealed tuberculous disease. Macroscopic examination of the tumor that had been removed showed it to be a large, anthracotic, lymphatic node, 2 x 1.5 cm. in size. Multiple small areas of calcification were scattered throughout the substance of the gland.

Within three days after bronchoscopy the patient's temperature became normal, and cough and expectoration gradually diminished.

He was permitted to return to his home September 27, 1939. Three months later he had gained 20 pounds in weight and appeared well; examination of the thorax revealed nothing abnormal save for chronic emphysema. Roentgenoscopic study of the thorax disclosed almost complete disappearance of the infiltration at the base of the right lung, which had been noted previously (Fig. 2).

116 E. FRANKLIN.

LXVIII

ATRESIA OF TRACHEA FOLLOWING INJURY: DILATATION WITH CORE MOLDS*

GEORGE O. CUMMINGS, M.D.

PORTLAND, MAINE

Crushing injuries to the larynx and trachea have so high an immediate mortality that little information concerning their treatment can be gleaned from recent literature except that if dyspnea is present a low tracheotomy should be performed early. In a series of 28 cases of laryngeal stenosis Clerf¹ reported that eight followed external trauma but that the stenosis in six of these was due to high tracheotomy. Schmiegelow² in a series of eighteen cases of laryngeal stenosis found but one due to external trauma. Stenosis or atresia of the trachea is sufficiently rare so that but one author, Jackson,³ suggests a type of treatment for it; nevertheless, the procedures found useful for similar conditions in the larynx are sufficiently applicable so that a review seems of value. While stenosis or atresia of the larynx may be caused by injury alone it usually follows infection plus perichondritis or trauma plus infection and perichondritis. It may then occur as a result of acute or chronic infections, laryngeal fractures, external or endo-laryngeal surgery for the removal of benign or malignant disease, the presence of foreign bodies, high tracheotomies (particularly in children with damage to the cricoid ring or conus elasticus), faulty intubation or overlong retention of the intubation tube, the use of an indwelling duodenal tube and deep x-ray therapy. When the cases reported in the literature are scanned, high tracheotomy in diphtheria is found to be the leading cause of this condition.

A low tracheotomy is the prerequisite for subsequent treatment. Selection of the method then depends upon the character of the stenosis or atresia and the condition of the cartilaginous framework of the larynx. Stenosis of the larynx with no deformity of cartilage should yield to peroral dilatation according to Clerf.¹ Atresia of the larynx with no cartilaginous deformity, or atresia or stenosis of the larynx with moderate cartilaginous deformity may be treated

*Presented before the annual meeting of the American Broncho-Esophagological Association, New York City, June 5, 1940.

by some type of in-dwelling laryngeal mold. Schmiegelow² states that as early as 1870 Von Schroetter used tin bolts and hard india rubber tubes, and in 1885 O'Dwyer reported successful results in treatment of five cases with his intubation tubes. Jackson⁴ has developed and perfected this method, having designed a graded series of solid core molds. As the constant pressure of an aneurysm will cause bone to be re-absorbed so will the constant pressure of soft core molds cause re-absorption of scar tissue and displaced laryngeal cartilage; at the same time epithelium will grow along the sides of the lumen occupied by the core molds. The philosophy of this type of treatment is simple and logical. It demands no external surgery but does not preclude its use later if necessary. Stenosis or atresia of the larynx with marked cartilaginous deformity may be treated with core molds or by laryngostomy with excision of the obstructing cartilage and scar and the placement of molds sometimes used as stents for skin grafts within the larynx. Schmiegelow² and Jackson³ have made notable contributions to the development of the external operation plus the placement of intra-laryngeal molds. Arbuckle⁵ and Figi⁶ advocate similar procedures combined with the use of Thiersch grafts over soft stents. Babcock⁷ suggests a method of closing laryngostomic fistulas by the implantation of a chondro-cutaneous flap. Negus⁸ remarks that in certain instances a permanent tracheostomy gives rise to surprisingly little disability, particularly when counterbalanced by an abundant airway and preservation of the voice.

REPORT OF A CASE

Benjamin Brown, aged 26, entered the Maine General Hospital October 1, 1938, and was discharged for further treatment April 10, 1939. The day before admission, while riding in the back seat of an automobile, the car stopped, throwing him suddenly against the back of the front seat so that he struck his neck below the level of the larynx. He temporarily lost consciousness and thereafter had marked dyspnea, was unable to speak and raised small amounts of blood.

On admission to the hospital he was found to be in fair condition with moderate dyspnea. Subcutaneous emphysema extended from the lower face to the mid-chest anteriorly and to the mid-scapula posteriorly. His larynx could be but partly visualized with a mirror.

On the next day his subcutaneous emphysema and dyspnea increased, and a low tracheotomy was performed over a 7-mm. bronchoscope which was passed without difficulty.

On October 17 he was unable to breathe through his larynx when his tracheotomy tube was blocked, and on the following day at a direct laryngoscopy it was discovered that the tracheal airway one and one-fourth inches below the vocal cords was impenetrable by bronchoscope or bougie.

Subsequent x-ray examinations showed that there was a definite break in the continuity of the air-filled trachea for a distance of one and one-half inches below the region of the vocal cords. This was clearly demonstrated by introduction of lipiodol into the larynx.

On November 23, fifty-four days after his accident, under a general anesthesia the tracheal occlusion was perforated with a No. 14 core mold introduced. The following difficulties were encountered. The tracheotomy opening, which had been allowed to close down to the size of a No. 4 tube, was enlarged for greater ease in picking up the braided silk thread from the carrier, and the lower portion of the larynx and the trachea above the tracheotomy opening was exposed in order to give a better sense of direction to the laryngeal knife. An anterior commissure laryngoscope was introduced between the cords as a short bronchoscope. The sheathed laryngeal knife was then found to be too short to penetrate the area of atresia and appear at the tracheotomy opening; therefore a regular direct laryngoscope had to be used and the area of atresia blindly perforated with the sheathed laryngeal knife. It was then found that the sheath did not permit the knife to penetrate the atresia and appear below, so the bare knife had to be used. It was then discovered that it was impossible to pull the No. 14 core mold through the knife wound. The sheath was accordingly replaced on the knife and pushed down over it as a rasp to enlarge the opening, after which the core mold slipped into place easily.

Subsequently larger core molds were introduced every 15 or 20 days until a No. 38 French was introduced on July 19.

A sponge carrier was used to carry the braided silk thread through the larynx to the tracheal opening. A Hartman curret-bladed ear forcep was most suitable for withdrawing the thread from the tracheal opening. General anesthesia was used at most of the direct laryngoscopies. The core molds were tied to the tracheotomy tubes and remained in place well except that on one occasion a core mold was coughed up; at another time the expanded head of the core mold slipped below the vocal cords and was removed with difficulty and slipped again when the tie about the tracheotomy tube reversed the position of the mold. The core molds had to be short-

ened about one-fourth inch so that they would not ride up from the pressure of their lower ends on the tracheotomy tube.

On August 14 the last core mold was removed. The patient had worn them continuously for eight and a half months without discomfort. At this time some edema of the arytenoids was present. Laryngeal dilators up to No. 36 French were passed by the strictured area as were a seven and nine mm. bronchoscope. There was some granulation tissue on the posterior wall of the trachea.

Subsequently the strictured area has been inspected and dilated on September 9, October 12, 1939, January 15 and April 15, 1940, and has shown but little tendency to contract. The tracheotomy tube was removed on November 3. The vocal cords are somewhat bowed and the voice hoarse but adequate.

47 DEERING STREET.

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LXIX

SO-CALLED CARCINO-SARCOMA OF THE ESOPHAGUS*

SAMUEL J. PEARLMAN, M.D.

CHICAGO

The most common malignancy to occur in the esophagus is carcinoma, while sarcomas are quite rare. Rarer still, however, are those tumors of uncertain histology and origin which have variously been named carcinosarcoma, sarcocarcinoma or carcinoma-sarcomatodes.

Though the subject of carcinosarcoma has always been one of interest since the time of Virchow, it has likewise been a subject of controversy, and there has been no unanimity of opinion among pathologists and oncologists as to the existence of such an entity. This has especially applied to individually reported cases.

Because of this and stimulated by the recent monograph on the general subject of carcinosarcoma written by Saphir and Vass, it was determined to make a special study of carcinosarcoma of the esophagus.

Neoplasms of the esophagus are of foremost importance to the endoscopist. Moreover it is of interest that the question of the possible dual origin of tumors was first suggested in connection with these tumors of the esophagus. Thus Herxheimer first coined the expression "carcinoma sarcomatodes" in reference to an esophageal tumor.

In respect to these tumors, they were first described by Virchow under the name of carcinosarcoma. Hanseman stated that this term should be used only if very close relationships could be established between the carcinomatous and sarcomatous components of the tumor. Saltykow reserved the term "carcinoma sarcomatodes" to tumors in which a purely epithelial tumor had a sarcomatous aspect. According to one theory of the genesis of such tumors, the carcinosarcoma is caused by a sarcomatous transformation of the stroma of a primary tumor. In other words an atypical proliferation of the

*From the Departments of Otolaryngology and Pathology of Michael Reese Hospital.

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connective tissue is stimulated by the epithelial component. Vice versa, a secondary cancerous degeneration of epithelial formations in a sarcoma must be considered. "Mutation or composition tumors" is the term applied to such neoplasms. This hypothesis of a sarcomatous degeneration of the stroma of a cancer is supported by Ehrlich and Apolant's experimental researches which demonstrated the possibility of a transformation of a cancer into a sarcoma in serial inoculations. For instance an adenocarcinoma may show a sarcomatous proliferation after having been transplanted several times from one animal to another. According to another theory the carcinosarcoma develops from a complex embryonal nucleus containing epithelial and fibrous capacities. Krompecher postulates still another theory according to which a direct transformation of a carcinomatous into a sarcomatous cell may take place. Meyer classified these tumors into three groups according to their possible mode of origin: (1) "collision tumors", two primarily independent tumors mutually invading each other; (2) "combination tumors", the product of the growth of two different blastomatous portions derived from one stem cell; (3) "composition tumors" in which both parenchyma and stroma have become blastomatous.

Although these classifications and theories have been more or less accepted, yet various pathologists have warned of the difficulty of such a diagnosis and questioned the existence of such an entity. These opinions have been well correlated by a recent critical study of Saphir, who showed that in a series of tumors, principally epithelial, more than one type of apparently epithelial element was often present. In some tumors, particularly those diagnosed as squamous-cell carcinomas with transitional cell features, the latter often assumed spindle forms which upon cursory examination might easily have been mistaken for sarcomatous elements. It requires many sections to trace the change from transitional and basal cells to the spindle-shaped, sarcoma-like elements. Thus these tumors might have been interpreted as carcinosarcomas.

Such a danger has been often noted by histopathologists. Wells pointed out the ease of interpreting spindle-shaped epithelial cells as connective tissue cells. Ewing believes that most of the so-called carcinosarcomas may arise by the transformation of epithelial cells into spindle cells. He believes that this change is facilitated by rapid growth of the tumor, relief of pressure and an inflammatory exudate, and that it is but rarely diagnosed as carcinosarcoma. Karsner also remarks that reactionary connective tissue growth may lead to elongation of epithelial cells.

Herzog, who described one case of carcinosarcoma of the esophagus, warned against this diagnosis because of the extreme morphologic variability of some carcinomas, particularly of this organ. Del Pozzo, Semb and Kettle also conclude that many of these supposed dual tumors are merely examples of extreme polymorphism of carcinoma cells, while Willis goes so far as to doubt the authenticity of all human reported carcinosarcomas and believes that those reported are merely instances of morphologic variability.

With these conflicting opinions in mind this study was undertaken. It consists of critical analysis of the seventeen cases of carcinosarcoma of the esophagus reported in the world's literature and a histopathological study of the cases of carcinoma of the esophagus available to us. These latter were studied with the possibility in mind of a diagnosis of carcinosarcoma.

REVIEW OF THE LITERATURE

Hanseman in 1904 wrote a dissertation on the simultaneous occurrence of various tumors in the same person. He states that the term "carcinoma sarcomatodes" should be used only in the description of carcinomas with a sarcomatous stroma. He reports observing one such case of the esophagus, but no histopathological description is given.

Herxheimer in 1908 called attention to a carcinoma sarcomatodes of the esophagus which he said was the first one to be studied in this organ. Pieces of this tumor at biopsy consisted of oval and polyhedral cells. Connective tissue was scanty. There was no hornification. The cells were considered to be like those of a sarcoma, but it was felt that they might be epithelial cells. The impression was that it was a carcinoma, a variant of a flat, epithelial carcinoma without horny components. However the autopsy specimen showed masses of spindle cells considered a typical sarcoma of mixed spindle cells. Giant cells were also seen. Within this stroma or surrounding it were islands of flat epithelial masses, typical cancrioid. Herxheimer remarked that the nuclei of both kinds of cells (sarcoma and carcinoma) are quite similar, and that the carcinoma islands, especially at the edges, resemble the adjacent sarcoma cells very much and simulate conversion into them. However, he felt that he could differentiate between the two sorts of cells, that the tumor was a carcinoma sarcomatodes, and that the rapidly growing component was a sarcoma.

Sokolow in 1912 described a carcinomatous ulcer in the lower portion of the esophagus. Sarcomatous tissue with cells which were either round or spindle-shaped was revealed histologically. Cavities lined with epithelium and also clusters of epithelial cells were embedded in this sarcomatous tissue.

Herzog described a tumor of the esophagus in 1914 which consisted of quite small, compact groups of cells between which were numerous epidermal globular cells. Often the cells were heaped up and spindle-shaped. There were all stages of pearl formation in the carcinomatous portion. Regional lymph nodes were involved and showed both small cell growth (sarcoma) and horn-pearl formation (carcinoma). Liver metastases consisted of spindle cells (sarcoma), and no carcinomatous elements were demonstrated. Herzog believed that Herxheimer's tumor was identical with his own.

Socin reported a case of carcinosarcoma of the esophagus in 1916. It arose in a pulsion diverticulum whose origin was ascribed to a developmental injury. Socin's explanation was that probably the same developmental injury had led to a constriction of embryonal tissue which perhaps under the influx of stagnant esophageal remnants caused the neoplasm to originate. Histologically, there were individual masses of typical epithelial cells between which was laid down a diffuse stroma of sarcomatous spindle cells. Socin also remarks about the vague demarcation between sarcoma and carcinoma.

Herxheimer's next case was in 1918. This revealed carcinoma cell nests and strings embedded in a stroma relatively rich in point-like spindle cells. In some places practically the only cells occurring were the spindle forms, and in these places the customary picture was of a spindle cell sarcoma. Some giant cells were seen. In places the boundary between carcinoma and sarcoma was very sharp; in places the limits were differentiated with difficulty.

Lang's two cases appeared in 1921. The first case showed carcinoma cells characterized by flattened, horny epithelium surrounded by a uniform picture of equally proportioned round and polymorph cells and giant cells, interpreted as a sarcoma. Lang, as other authors, remarked that the limitations of the epithelial cell growth was in part not sharply defined against the conspicuous sarcomatous stroma; in part the differentiation was easy. Metastatic nodules in the liver appeared to be pure sarcoma. His second case was described as microscopically similar to the first.

The next case is Heilmann's in 1923. Grossly it was a polypoid tumor 14 cm. long. Microscopically there was a smooth epithelial growth with pearl formation seen in small islands and strings as in a scirrhus carcinoma. The stroma was so rich in cells that it gave the impression of a sarcoma. It consisted of cells with large nuclei but almost no plasma, of round cells, and in places spindle cells. Frequent giant cells were seen, often in mitosis. The sarcomatous stroma was sharply demarcated from the epithelial elements. In places the stroma was hyalin and poor in cells. The body of the tumor seemed primarily sarcomatous, but the picture at the base of the polypoid mass was more that of a horny epithelial carcinoma. The whole tumor appeared as if the carcinoma masses were being pressed fan-wise or radially toward the peripheral parts of the tumor by the sarcomatous basal tissue and were being constantly lost by the all-consuming sarcoma. The author admits that the giant cells might be thought of as foreign body giant cells which were devouring the cancer cells.

Cilotti's case in 1928 had metastases in lungs, liver, ribs, pancreatic tissues and pathological fractures of two ribs. The tumor consisted of sarcomatous tissue with scattered epithelial formations. The liver nodules had a definitely sarcomatous structure, but careful search also revealed the presence of epithelial formations. Similar nodules were found in the lungs, ribs and periesophageal nodes. The peripancreatic mass was characterized by greater polymorphism. Cilotti states that while the primary tumor was undoubtedly a carcinosarcoma, the metastases had a nearly exclusively sarcomatous character.

Scarff's report in 1929 is the first appearing in the English literature. Biopsy specimen showed spindle cell masses, fibroblasts, blood vessels and multi-nucleated giant cells. The diagnosis was giant-cell sarcoma. However microscopic sections from portions of the growth showed it to be composed of two separate, sharply demarcated elements, connective tissue and epithelial cell masses. The former was similar to the tissue described as the sole component of that portion of tumor removed during life and consisted of spindle cells and multi-nucleated giant cells. There were numerous hyperchromatic nuclei and scattered mitotic figures. Epithelial portions were generally undifferentiated epithelial cells. The cell masses showed central keratinization.

Kahlstorf described two cases in 1930. The first case had a carcinomatous component consisting of hornified epithelium, and

the sarcomatous portion was polymorphocellular. There were widespread metastases to liver, kidneys, adrenals, heart and subperiosteal portions of numerous bones. These showed the sarcomatous tumor. The author believes this to be a real carcinosarcoma. He remarks that sometimes a proliferation of the stroma may be of a reactive or resorbative nature, but in such cases no metastases containing the mesenchymal component can be found.

His second case appeared to be a hornified pavement-cell carcinoma on biopsy. The autopsy specimen consisted mainly of undifferentiated tumor cells. Giant cells and occasional calcified cells were visible. A description of the sarcomatous element is not given. There were metastases in the liver and the paratracheal and cervical lymph nodes.

Carnevale-Ricci reported a case from Milan in 1931. Grossly, there was a pedunculated tumor in the lower third of the esophagus. Histologically, there was a pseudoalveolar formation in a sarcomatous stroma. The character of the epithelial neoplasm was that of a basaloma, while the sarcomatous component consisted of polymorph cells, some with scanty protoplasm and a centrally located nucleus, some of an ovoid shape and eccentrically located nucleus, still other cells spindle-shaped. There were no metastases.

The next report is that of Resch in 1932. In his tumor epithelial cellular masses formed elongated, ramified, anastomosing bands embedded in a stroma rich in cells. The epithelial cells in some places showed a slight hornification. The stroma consisted of spindle-shaped cells located close to one another. There was a scanty reticulum, but in numerous places an interstitial tissue was demonstrable between the spindle-shaped cells.

Bosenberg in 1932 discussed six cases of carcinosarcoma of various organs, but without a histopathological discussion.

Tumor sections from Blackburn's case in 1934 were reported as having the structure of a spindle-cell sarcoma. In some areas it looked like an anaplastic carcinoma and in other areas it was sarcomatous. Some doubt was felt as to its nature.

The following eight cases of malignancy of the esophagus have been autopsied at Michael Reese Hospital. They have been studied with the thought in mind of how their histopathological picture might be reconciled with a diagnosis of carcinosarcoma, and whether the microscopic picture is similar to that described in the world's literature for carcinosarcomas.

CASE I.—Revealed groups of variously sized and shaped polyhedral cells arranged in cords and sheets embedded in a partially hyalinized stroma. There is a tendency to pearl formation. Interspersed with large squamous cells are spindle-shaped and oval transitional cells which might be interpreted as sarcomatous (Fig. 1).

CASE II.—The tumor consists of cells arranged in cords, sheets, plaques, and clusters. The cells are oval, polyhedral or spindle-shaped, with marked variation in size. In some areas these anaplastic cells appear to be transformed into long and short elongated and spindle-shaped hyperchromatic cells. In addition, there is a very cellular fibrous stroma, and this in addition to the spindle-shaped carcinoma cells simulates a connective tissue tumor (Figs. 2 and 3).

Metastases to lymph nodes, suprarenal glands and liver had the characteristics of anaplastic carcinoma.

CASE III.—The tumor is composed of sheaths and strands of epithelial cells which varied much in size, shape and staining quality. In areas they look much like basal cells. There is a tendency to pearl formation. Scattered throughout tumor and stroma are lymphocytes, singly and in groups. Such a formation may be erroneously diagnosed as a carcino-lymphosarcoma (Fig. 4).

CASE IV.—Consists of large and small sheets of tumor cells. Some are round, some polygonal. Polyhedral squamous cells are surrounded by transitional cells and these in turn by a connective tissue stroma (Fig. 5). Similar tumor cells are seen in mediastinal, axillary, perigastric and periduodenal lymph nodes.

CASE V.—Consists of polymorphous epithelial cells, varying in both size and shape. Spindle-shaped epithelial cells invade the connective tissue stroma which also contains many lymphocytes. The transition from epithelial plaques to cellular stroma is often imperceptible (Fig. 6). Metastases to lungs and lymph nodes revealed carcinoma cells of transitional type and a number of multi-nucleated giant cells.

CASE VI.—Epithelial cells, squamous in type, invade throughout all the layers of the esophagus. There is much anaplasia and variation in size and shape of cells. There are many spindle-shaped fibroblasts and lymphocytes in a granulation tissue stroma (Fig. 7). In places sheets of epithelial cells invade the smooth muscle tissue (Fig. 8). Both of these mesodermal elements might be interpreted as a sarcomatous component.

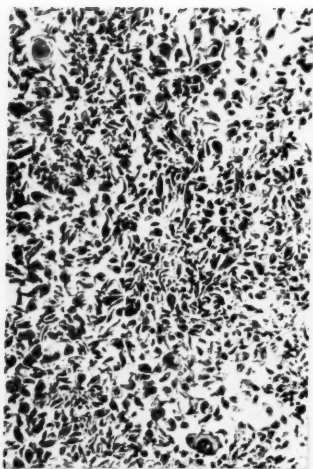


Fig. 1

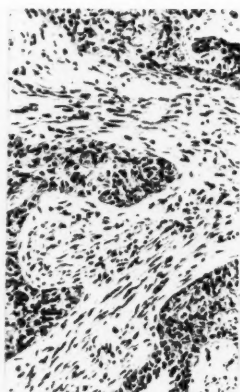


Fig. 2.

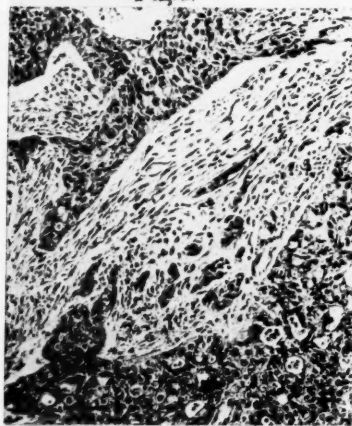


Fig. 3.

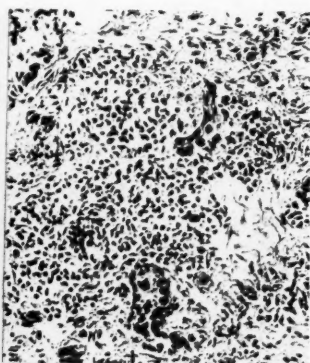


Fig. 4.

Fig. 1. Note the spindle-shaped and oval transitional cells intermingled with large squamous cells in esophageal carcinoma. Iron-hematoxylin and eosin preparation x 120.

Fig. 2. Squamous cell carcinoma of the esophagus. Note the many spindle-shaped connective tissue cells simulating a connective tissue tumor. Iron-hematoxylin and eosin preparation x 100. Pictures similar to this are often referred to in the literature as carcinosarcoma of the esophagus.

Fig. 3. Squamous cell carcinoma of the esophagus. Iron-hematoxylin and eosin preparation x 100. Note the islands of squamous cells surrounded by spindle-shaped connective tissue cells.

Fig. 4. Note the squamous cells and many lymphocytes in squamous cell carcinoma of the esophagus. Iron-hematoxylin and eosin preparation x 140. The presence of lymphocytes may lead to an erroneous diagnosis of carcinosarcoma.



Fig. 5.

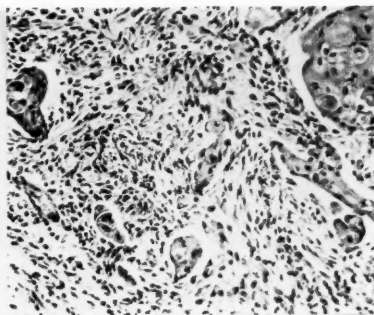


Fig. 6.

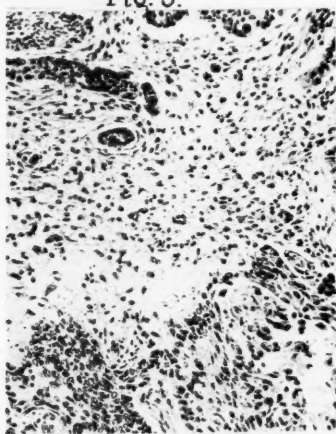


Fig. 7.

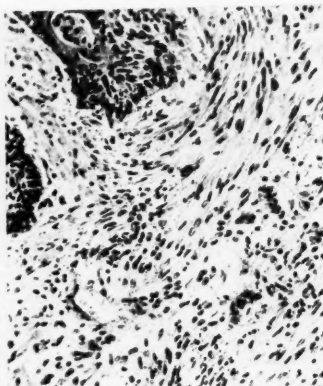


Fig. 8.

Fig. 5. Squamous cells surrounded by transitional cells in esophageal carcinoma. Iron-hematoxylin and eosin preparation x 135.

Fig. 6. Chronic inflammation and squamous cell carcinoma of the esophagus. Note the many round and spindle-shaped cells. Iron-hematoxylin and eosin preparation x 100.

Fig. 7. Plaques of squamous cells with many fibroblastic cells (granulation tissue). Iron-hematoxylin and eosin preparation x 100. The spindle-shaped cells may be confused with sarcomatous elements, in so-called carcinosarcoma.

Fig. 8. Plaques of carcinoma cells adjacent to smooth muscle cells and fibrin. Iron-hematoxylin and eosin preparation x 125. The muscle cells simulate the sarcomatous component of some of the so-called carcinosarcomas.

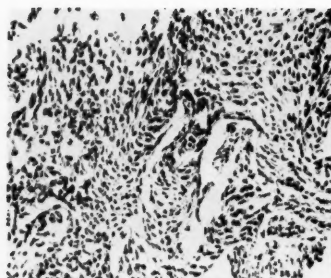


Fig. 9.

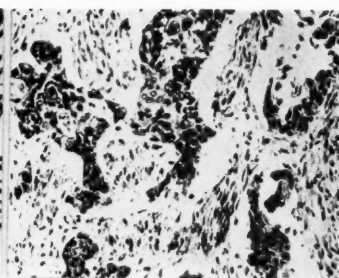


Fig. 10.



Fig. 11.

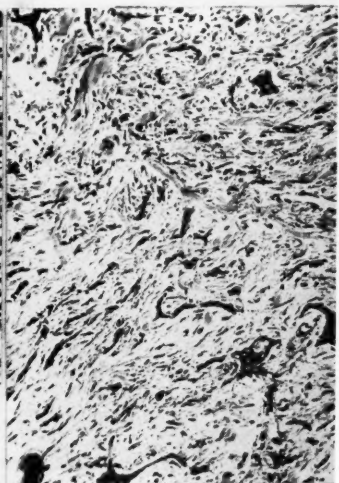


Fig. 12.

Fig. 9. Transitional cell carcinoma of the esophagus. Iron-hematoxylin and eosin preparation x 110. Note the spindle-shaped cells which may be confused with sarcoma cells. This field is taken from the same tumor as that pictured in Fig. 10 which shows the squamous cell carcinoma component of this tumor.

Fig. 10. Squamous cell carcinoma of the esophagus. Iron-hematoxylin and eosin preparation x 110. This is another field of the same tumor which is pictured in Fig. 9. Note the morphologic variations in this tumor.

Fig. 11. Metastases of carcinoma of the esophagus (same tumor as pictured in Figs. 9 and 10). Iron-hematoxylin and eosin preparation x 130. Note the plaques of squamous cells in the upper field and transitional cells (round and spindle-shaped) in the lower field of the picture.

Fig. 12. Esophageal carcinoma. The tumor cells are compressed, simulating connective tissue cells. Iron-hematoxylin and eosin preparation x 110.

CASE VII.—This tumor is remarkable for its morphologic variation. In areas it is almost entirely composed of spindle-shaped transitional cells (Fig. 9) while elsewhere are solid masses of squamous cells, often showing hornification (Fig. 10). Widespread metastases to lymph nodes, liver and peritoneum have both squamous cell (carcinoma) and transitional cell "sarcoma" components (Fig. 11). This tumor could be interpreted as a mixed type of cancer with mixed metastases.

CASE VIII.—The tumor consists of hyperchromatic, anaplastic epithelial cells. There is a marked connective tissue reaction of the stroma, and the epithelial cells here invading are compressed and distorted, appearing much like connective tissue cells (Fig. 12). Metastases to lymph nodes reveal sheets of anaplastic epithelial cells.

DISCUSSION

It is not possible to state dogmatically that the cases of carcinoma so reported in the literature are incorrect; for an individual case may really fall into this category. But it is very probable that most of the so-called carcinosarcomas of the esophagus are really primary carcinomas. The descriptions in the literature reveal a fundamental similarity which, in turn, seems very analogous to the description of the malignancies which we have studied. They, for the most part, seem to be anaplastic carcinomas or squamous cell carcinomas with transitional cell features, and these transitional cells are frequently elongated and spindle-shaped and could easily be confused with sarcoma cells. It is of interest and of great significance as will have been noted in the description of cases in the literature that many of the authors state that the boundary between sarcomatous and epitheliomatous elements is indistinct. This, undoubtedly, was because the anaplastic and transitional cells showed a gradual change from the flat squamous cells to the elongated spindle cells which were interpreted as sarcomatous, but which from the present-day knowledge of histopathology are firmly established as carcinomatous. As has been stated by Saphir and Vass, "the number of carcinosarcomas reported in the literature can be interpreted (as carcinomas) on the basis of morphologic cellular variations."

Another source of confusion in the past has undoubtedly been due to the erroneous interpretation of primary carcinomas complicated by chronic productive inflammatory changes. These may give rise, as we have seen in our cases and a number reported in the literature, to a cellular, dense stroma in which may be many lymphocytes and probably giant cells. This reaction is not sarcomatous

but is most likely in the nature of a foreign body reaction. Difficulties of interpretation may also be caused by the dense connective tissue stroma resulting in compression of epithelial cells leading to morphologic changes in these cells. Finally, the polypoid mixed tumors reported are, in all likelihood, carcinomas which have invaded a previously existing benign connective-tissue tumor for which the walls of the esophagus are favorite sites. These benign tumor cells, young fibroblasts and giant cells which are not unusual in these neoplasms were interpreted as sarcoma cells.

CONCLUSION

From a study of the world's literature of carcinosarcoma of the esophagus and of eight cases of carcinoma of the esophagus studied at autopsy it seems clear that the existence of so-called carcinosarcomas in the esophagus as elsewhere is very questionable. The possible sources of error leading to such a diagnosis were analyzed and discussed.

55 E. WASHINGTON.

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BRONCHOSCOPIC TREATMENT OF LUNG ABSCESS:
REPORT OF FORTY-THREE CASES*

M. F. ARBUCKLE, M.D.

ST. LOUIS

Apparently there is lack of unanimity of opinion as to the best method for treating lung abscess. Obviously no one method is applicable to all cases. Generally speaking there are two methods, which in actual practice more or less merge; these are the so-called medical care on the one hand and surgical care on the other.^{1, 2, 3, 4, 5}

The internist who usually carries out the medical care favors bed rest with postural drainage and peroral and intravenous medication.⁶ The surgeons are not in agreement in that some⁷ favor very early surgical intervention, whereas nearly all others favor a period of medical care to be followed by surgical intervention if necessary, but they usually operate on all cases that come into their hands sooner or later. It is true that many cases of lung abscess recover with medical care alone. It is also true that a good many cases of lung abscess go on to recovery without ever seeing a doctor. Of the group who do not recover with medical care a large number recover with surgical intervention, but in both instances the mortality rate as well as the duration of the disease is distressing to both doctor and patient. Surgical intervention is accompanied by hazards of the most serious nature.

We believe that in practically all cases of lung abscess both the duration of the disease and its severity may be diminished by proper bronchoscopic drainage. Furthermore, our experience has shown about one half of all cases which are free of complications, such as empyema, gangrene, etc., may be cured by bronchoscopic removal of the granulation tissue in the bronchial fistula, the application of suction to the contents of the cavity itself, the installation of remedies at least thought to be beneficial directly into the abscess cavity, and by postural drainage. When patients are cured by this method they escape the hazards of thoracotomy and cauterization of the lung

*Presented before the annual meeting of the American Broncho-Esophagological Association, New York City, June 5, 1940.

as well as possible postoperative hemorrhage or embolism or sepsis, not to speak of the disability caused by the removal of ribs and lung tissue. Their hospital stay may be shortened by weeks or even months if cured by bronchoscopy.

In order to avoid a possible mistaken impression we wish to make it clear that we do not have the belief that all cases of lung abscess are amenable to treatment by bronchoscopy alone and that when conditions indicate thoracotomy we are the first to recommend it and insist upon it. It is possible that rupture into the pleura may result from pressure in an abscess cavity which is gradually increased when the bronchial fistula is blocked by granulation tissue. If this obstructing plug of granulation tissue can be removed and its recurrence prevented, the pus may flow into the bronchus and be coughed out; this would presumably be promoted by postural drainage. By the introduction of guaiacol and possibly lipiodol we feel that fermentation and possibly necrosis and putrefaction are diminished. We have seen the pus and the odor promptly disappear on many occasions after this form of treatment had been carried out.

By bronchoscopic treatment of lung abscess we mean destruction of granulation tissue by the use of forceps and curettes, removal by suction of the contents of the abscess by means of special tubes made for this purpose which are introduced directly into the cavity, and the installation of guaiacol with one per cent oil of sweet almonds, or lipiodol. Of course, in order to carry out this procedure without unnecessary delay and at the same time with accuracy, it is necessary that the abscess be localized as well as possible before the bronchoscopy is undertaken. This means careful preliminary x-ray and physical examination, which in itself usually implies close association between the bronchoscopist, the internist, the radiologist and the chest surgeon.

Objection to bronchoscopic treatment in such cases has been raised on the ground that these patients are too ill to submit to the procedure. When we realize that such patients, regardless of how ill, may in nearly every instance be bronchoscoped without harm, and when we compare the risk in this procedure with that of thoracotomy, which is our only alternative, it does not seem reasonable to me to recommend thoracotomy rather than bronchoscopy.

These remarks indicate our experience with a group of 43 consecutive cases. In this group (which has not been selected) are included acute, subacute and chronic lung abscess with a duration of two weeks to three and one-half years. The ages range from three

and one-half years to sixty-five years of age. Of the 43 cases 20 failed of recovery or satisfactory improvement by bronchoscopy alone. Of the remaining 23 cases, 19 made complete recovery and 4 improved very satisfactorily.

In the group of 20 cases the variety of abscess included acute, subacute and chronic. The ages were from three and one-half years to fifty-five years of age. The duration of the abscesses in this group ranged from seven weeks to one year.

In the group of 19 cases the variety of abscess included acute, subacute and chronic. The shortest duration was two weeks and the longest three and one-half years. The youngest patient was three and one-half years and the oldest, sixty-five years of age.

In the four cases improved by bronchoscopy and in which thoracotomy was not recommended the age of the patient and his general condition were deciding factors against thoracotomy. One was sixty-five years of age and was senile for his years. Another one had had repeated attacks of coronary thrombosis.

Total hospital days for the group of 20 were 1602 days; for the group of 23, 788 days.

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Society Proceedings

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Meeting of Monday, December 4, 1939

THE PRESIDENT, DR. GEORGE T. JORDAN, IN THE CHAIR

Mucocele of the Frontal Sinus

J. A. WEISS

(Author's Abstract)

Two cases of mucocele originating in the frontal sinus were reported. In the first, the noteworthy features included the giant size (10x8.5x6 cm.) atrophy of the optic nerve, excessive hypertrophy of the sac wall (8 mm. in thickness), formation of septa of membranous bone, and deep extension of the sinus into the orbital plate of the frontal bone. In the second case there was dural exposure, though the external swelling was small.

In each case the sinus was entered by an external approach through the door, the viscid contents evacuated and the naso-frontal passage enlarged.

The hypertrophied sac wall in the first case showed considerable fibrosis, capillary proliferation, hyperplastic pseudo-stratified columnar epithelium, and infiltration of cells of chronic inflammation. The adjacent bone presented areas of osteoclasia and absorption.

Mucoceles occur most often in the frontal and ethmoid sinuses, less frequently in the antrum and rarely in the sphenoid. The signs and symptoms depend on the size of the swelling and effects of pressure on adjacent structures, especially the eye.

The roentgenographic changes are variable. The most characteristic signs include enlargement of the sinus outline, destruction of the supraorbital ridge, and increased radiotranslucency.

Two factors are concerned in the formation of a mucocele. (a) Closure or narrowing of the sinus ostium, and (b) cystic de-

generation of a polyp or cystic dilatation of a gland. The former condition is not always present; the latter is of major importance.

Abducens Paralysis in Sinus Thrombosis

LEO A. SATZ, M.D.

(Abstract)

A white boy, aged 13, when first seen twelve days after a paracentesis had been performed on the right tympanic membrane complained of pain behind the right ear and in the zygomatic region and right sided headaches. The temperature on admission was 100.8 degrees. There was a leucocytosis of 17,000.

The symptoms of the sinus thrombosis were latent and the abducens paresis appeared ten days after an operation on the sinus.

Although some of the clinical symptoms along with the x-ray pictures pointed to a possible petrous tip involvement, the lack of continuous orbital pains, the moderate discharge from the wound, together with the excellent healing tendencies throughout the entire period, the good physical condition of the patient and the late appearance of the paresis made the decision difficult.

The clinical picture, including the paresis of the external rectus, could have been caused either by an osteitis in the petrous tip resulting from the diffusion of the infection in the tympanum, along preformed anatomical pathways, or by diffusion of periphlebotic changes, along the inferior petrosus sinus producing edema in the tissues surrounding Dorello's canal. The latter pathway, although rare, has been mentioned in the literature, especially in the presence of abscess in the neighborhood of the sigmoid sinus. Considering that an inconstant abducens paresis followed a sinus thrombosis and that low grade temperature and leucocytosis persisted it might be that involvement of the inferior petrosus sinus was responsible for the clinical picture. With this in mind and in absence of other threatening symptoms, surgical intervention was withheld.

DISCUSSION

DR. CARL CHRISTOPH: I would like to compliment Dr. Satz on his excellent presentation of a difficult case. In the differential

diagnosis, meningitis, brain abscess, involvement of the inferior petrosal, or of the cavernous sinus were considered. The patient had two important symptoms of petrositis, headache and sixth nerve paralysis. The headache was deep seated, and was not typically located behind the eye. The sixth nerve paralysis, while present, fluctuated in degree. It was a paresis rather than a paralysis. Thrombosis of the petrosal sinus seemed likely. The only explanation for the paralysis was on the basis of the edema.

As for treatment, watchful waiting was considered the best course. The fact that the patient made an uneventful recovery showed we were right in being conservative.

DR. BENJAMIN BOSHES: This patient had a stiff neck, and the differential diagnosis between a stiff neck and rigidity from meningitis had to be made. Ordinarily, in the latter case, the patient permits the examiner to rotate the neck from side to side. When we tried to rotate the neck, the boy complained of pain. The absence of confirmatory signs, like the Kernig, further indicated that this was not a meningitis.

The second point was the nature of the invasion from the ear. The possibility of a temporo-parietal lobe or an epidural abscess was considered. In the absence of choked disc one could rule against a space-occupying lesion. The abundance of a hemianopia ruled against a lesion in the temporal lobe. There was no adiadokokinesis. The presence of a sixth nerve palsy suggested a lesion within the cranium. If it had been an intrapontine paralysis it would have picked up the seventh as well as the sixth nerves. The presence of pain in the anatomic distribution of the fifth as well as the sixth nerve spoke for a lesion at a point where the two are contiguous. Consequently, our impression was that we were dealing with what the neurologist calls the "paratrigeminal syndrome," a lesion located in juxtaposition to the ganglion of the fifth nerve. Since it was our impression that there was no abscess or space filling lesion, and that we were not dealing with a meningitis, we concluded that the lesion must be local, near the tip of the petrosa.

I think the differentiation between a simple stiff neck and true meningitic neck has value, because many times a patient is so sick that we are reluctant to do a spinal puncture. Such small signs are useful in the differential diagnosis.

Complication of Caldwell-Luc Operation

BERNARD M. COHEN, M.D.

(Abstract)

A negro woman, aged 40, entered the clinic in 1937, complaining of frontal headaches and aching in her teeth. This she had had off and on for the past thirty years. Several irrigations of both maxillary sinuses were performed and she did not return until 1939, with a recurrence of these symptoms, the pathology being most marked on the left side. Radiologic studies of the sinuses showed extensive cloudiness in the antra with hypertrophic mucosal changes most marked on the left side. Irrigation of the left maxillary sinus failed to produce improvement.

On May 15, 1939, Caldwell-Luc operation was performed on the left side; a great deal of polypoid tissue was removed from the antrum and a counter-opening was made into the nose in the inferior meatus and a rubber tube drain inserted.

The early postoperative condition was satisfactory except for severe pain in left side of the face referred particularly to the preauricular region. On the fourth postoperative day, she had a chill and a temperature of 104 degrees. The following day, a definite circumscribed swelling of the parotid gland developed with redness and marked tenderness. (The antral washings continued clear.) A diagnosis of surgical parotitis was made and x-ray treatment given over the swollen area.

The temperature continued, a slight fluctuation developed in the parotid gland, and on the eleventh postoperative day the gland was incised and searched in vain for pus. In 48 hours, however, there was a profuse foul drainage from this incision and a bulging of the left soft palate and lateral pharyngeal wall was found. This was incised and the same foul pus encountered. Subsequent irrigation through either incision caused a flow through the other incision, so the diagnosis of pharyngo-maxillary fossa infection was established. For the next three days, fever subsided and the condition improved, but it soon recurred. On the twenty-first postoperative day incision was made along the left sternomastoid muscle, the carotid sheath exposed, the pharyngomaxillary fossa entered and pus drained. The internal jugular vein was ligated and cut.

The temperature gradually returned to normal and progress was satisfactory. However, on the thirty-second postoperative day

a fluctuant swelling developed in the midline of the neck just above the sternal notch. This was incised and foul pus encountered.

Subsequently, all incisions healed with subsidence of drainage. The patient had no complaints. On the fifty-third postoperative day she was found in a deep stupor, temperature 104 degrees, pulse 132. The neck was rigid, Babinski and Kernig positive and spinal fluid under increased pressure, cloudy; cell count 1200, polymorphonuclear cells predominating. Within a few hours, the patient lapsed into a deep coma and expired.

This was a case of suppurative surgical parotitis following Caldwell-Luc operation, the products of inflammation breaking through the deficient portion of the parotid fascia. This produced pharyngomaxillary fossa infection which descended and ascended from the original site. Descent was adequately halted by the surgical procedures employed but the ascending infection to the meninges caused the fatal termination.

DISCUSSION

DR. SAMUEL SALINGER: Why was the parotid invaded in the first place? It seems more than likely that the infection was transmitted by direct extension either through the original incision or by way of Stenson's duct. Usually in doing a Caldwell-Luc we forget about the parotid gland, but it can be easily traumatized, especially by too vigorous application of retractors. Once the infection enters the parotid gland it can pass to the pharyngomaxillary space which is in close apposition to its medial surface. Only last summer I saw a case of parotid infection following a pelvic operation with a subsequent terrific pharyngomaxillary infection which we were able to drain by the Mosher procedure. Once the infection has reached the pharyngomaxillary space it can invade the carotid sheath down to the sternum, as it did in Dr. Cohen's case. An ascending infection is less frequent but can take place by way of the carotid artery or the pterygoid venous plexus. This is the first time I have seen a complication of the type and I believe it interesting enough to be placed on record.

DR. JOSEPH BECK: Dr. Salinger called attention to the fact that parotid gland infection is reported, but it is not well known to most otolaryngologists, particularly the point that Dr. Salinger made regarding trauma from retractors. We had a case of facial paralysis following an operation of this type, and I believe that it was from

the retractors we used to get to the back part of the antrum in the removal of the osteal wall.

In general surgery, infections will go to the parotid or from the parotid to the rest of the body, particularly following gunshot wounds. Many cases, notably that of President Garfield, have been reported where parotid infection followed gunshot wounds. I think Dr. Cohen's presentation is very valuable and, since the Caldwell-Luc operation is so frequently done, attention should be called to a possible trauma.

Nasopharyngeal Tuberculosis

F. PISZKIEWICZ, M.D.

(Abstract)

C. B., a negro boy, aged 17, was admitted to the outpatient clinic on September 11, 1939. He gave a history of bilateral deafness and tinnitus of about nine months' duration. He stated that about nine months ago a swelling on the right side of his neck started as a small painless nodule which gradually grew in size to 2 cm. in diameter, then it ruptured spontaneously and discharged a thin whitish fluid. This sore remained open and discharging for about two weeks, became crusted over and healed up. About one month after the appearance of the swelling in his neck he noted that his hearing began to fail. The hearing loss developed very rapidly and to such a marked degree that he was compelled to leave school.

On examination the right ear drum was thickened and reddened and the left external auditory canal contained some yellowish-white discharge, which seemed to be coming from a small anterior perforation in the ear drum. There was an asymmetrical enlargement of the posterior cervical lymph glands, the right chain being larger and less discrete. There was no tenderness or fluctuation and on the right side of the neck the skin presented two small dimpled scars. The tonsils were moderately enlarged. The soft palate, uvula, and anterior pillars were infiltrated and of a leathery consistency. The posterior pharyngeal wall contained several enlarged raised reddish masses of lymphoid tissue. Digital examination of the postnasal space showed it to be narrowed and containing a soft spongy mass which bled very easily.

The blood count was normal. The hemoglobin was 91 per cent. Blood Wassermann was negative. The Mantoux test was strongly

positive. There was bilateral deafness to the ordinary conversational voice and a lower tone limit of 256 and an upper tone limit of 1024. Cold alcohol stimulation of both labyrinths resulted in normal responses. A biopsy of the nasopharyngeal tissue was reported as tuberculous granulation tissue. Roentgen examination of the chest showed no abnormal findings. The cervical vertebrae appeared normal on x-ray. Sputa repeatedly were negative for tubercle bacilli. He was referred to the Tumor Clinic where he received small doses of x-rays for a period of twelve days. The total dosage given was 66 roentgens.

Re-examination three weeks after the radiotherapy showed an almost complete absence of lymphoid tissue in the mouth and pharynx, and no mass in the nasopharynx. The soft palate was thickened and leathery hard and the regions of both eustachian orifices were firm and infiltrated. The hearing showed no material improvement and the left ear was moist. Following the original biopsy, more tissue was removed for further study and guinea pig inoculation. Smear of this tissue failed to reveal any tubercle bacilli.

Conclusion: This is a case of nasopharyngeal tuberculosis, with a bilateral lymphadenitis, probably tuberculous, and a bilateral deafness. No pulmonary or tracheo-bronchial tuberculous lesion could be demonstrated. Further studies are being carried out to determine the nature and type of tuberculosis present.

DISCUSSION

DR. ALFRED LEWY: This patient was sent to the Tumor Clinic in the belief that it was nasopharyngeal fibroma, because I thought the mass felt hard. We have not yet a report on the guinea pig inoculation. The slide appears to be characteristic. The boy's general condition is very much better. He has grown three inches in height and is much heavier, and has a great deal more energy than when I first saw him. We do not know where this tuberculosis originated, whether in the cervical glands and then by a retrograde process appeared in the nasopharynx. The loss of hearing suggested that the middle ear infection may also be tubercular. This loss of hearing was very rapid. I will know more about him after our guinea pig inoculation is complete.

DR. FRANCIS L. LEDERER: The epipharynx is seldom the site of primary tuberculosis, and when the lesion is in this area there is usually chronic pulmonary tuberculosis. This particular area is of significance from a diagnostic and therapeutic point of view, for quite often it is a focus of re-infection of the ears as well as the pharynx, since the lymphatic tissue of the epipharynx is part of

Waldeyer's Ring. This patient had a cervical adenitis, a remnant of the old scrofulous type of infection. In a number of these patients fistulous tracts have formed going back into the nasopharynx and communicating with the adenitis, which is the primary source of infection. A more complete history might establish the fact that it is an acid-fast type of infection, as Dr. Lewy intimates. A cervical spine osteomyelitis on a tuberculous basis is also a possibility.

This case proves again what has been emphasized in the past, namely, the necessity of close observation of the epipharynx as a source of tuberculosis. There are two types observed here. The first is the more chronic type. The second type that we usually see in this area is the miliary form of tuberculosis associated with the laryngeal form when the pulmonary tuberculosis is primary. These cases are often associated with tuberculosis in Peyer's patches of the intestines. The patient develops a tuberculous enteritis with this particular condition. However, I do not believe we can look upon this case as a primary tuberculosis of the nasopharynx, but one that is secondary to a cervical adenitis.

DR. SAMUEL SALINGER: This case presented a typical triad of symptoms which might lead one to believe it was a malignancy. The patient had ear symptoms, a mass in the nasopharynx and enlarged cervical glands. Two facts, however, would rule out carcinoma. First, the symptoms developed rapidly, and second, the lymph glands broke down early. This never occurs in malignancy. The only other condition that might do this would be actinomycosis. It is speculation to try to figure out whether the infection was primary in the nasopharynx or secondary to a cervical gland infection. I am more inclined to believe that this patient had an old primary tuberculosis in the chest, and that the nasopharynx was involved by metastatic infection with secondary invasion of the glands.

Two Cases of Labyrinthitis

FREDERIC J. POLLOCK, M.D.

(Abstract)

This report covers two patients with labyrinthine involvement associated with otitis media.

The first patient was a man, aged 35, who complained of deafness and tinnitus in his right ear for six weeks. Eleven days prior

to admission he developed a postauricular swelling and discharge from the right ear. The tympanum was intact, but there was a fistula in the posterior wall of the external auditory canal. Hearing was reduced to one foot. The Rinné test was negative, and the Weber lateralized to the affected ear. Rotation tests showed that both labyrinths were normal. The blood Wassermann was negative.

Although an external otitis with a postauricular abscess was suspected, the x-ray showed extensive destruction in the mastoid cells. A simple mastoidectomy was done; a fistula was found in the cortex, and another in the posterior wall of the external auditory canal. A very pneumatic mastoid was found, with broken down cell walls, and filled with granulations. Culture showed a mixture of organisms, with staphylococcus overgrowing the others.

Recovery was uneventful, except for continuance of a postauricular discharge. Five weeks later, while still under care, he developed dizziness, nausea and vomiting, headache, tinnitus followed by deafness, horizontal rotatory nystagmus of a second degree to the opposite side, and past-pointing. There were no signs of meningeal involvement. The temperature was 99.2 degrees. Caloric tests showed a dead labyrinth on the affected side. A lumbar puncture revealed 20 cells, of which 90 per cent were lymphocytes. The spinal fluid pressure was normal. Ninety grains of prontosil daily was begun, and the following day the temperature became normal, the nystagmus much less marked, and the patient felt much better. Another lumbar puncture two days later showed 15 cells. The prontosil was continued in doses of sixty grains daily. The patient continued to make an apparent improvement.

Ten days after the onset of the labyrinthitis, he suddenly developed a temperature of 104 degrees, a severe headache and a stiff neck. Lumbar puncture showed 3500 cells, and a culture showed streptococci. An x-ray showed no involvement of the petrous apex. A radical mastoidectomy was done, the semicircular canals opened, and the wall of the promontory broken through. The patient died four days later. No autopsy permit was obtained.

The second case was a man aged 26, who had had a purulent discharge from his left ear since he was one year old. For ten days prior to admission he had noted a dull pain over the left mastoid, and for three days he had had vertigo and nausea. The temperature was 100 degrees. A spontaneous second degree nystagmus to the right was noted. Examination showed an almost complete obstruction of the drum, with a middle ear filled with granulations; x-ray

studies revealed a large cholesteatoma. Hearing in the affected ear was limited to conversation on contact, with masking of the other ear. The Weber lateralized to the good ear. Fistula test did not increase the nystagmus. There were no signs of meningeal involvement. The blood Wassermann test was negative. On conservative treatment, the temperature gradually returned to normal. All hearing disappeared, except by bone conduction. A slight facial weakness became apparent. The dizziness and nausea disappeared, and nystagmus could no longer be elicited. Three weeks after the onset of the labyrinthine storm, rotation tests showed a dead labyrinth, and all hearing, both by ear and by bone, was gone. He was discharged from the hospital.

Nine days later he was again admitted because of headaches, elevation of temperature. A lumbar puncture showed 70 cells, mostly lymphocytes, and a positive Pandy test for globulin. A Wassermann test was reported four plus, and the Lange gold curve indicated *tabes dorsalis*. Anti-syphilitic therapy was instituted. Two months after this therapy was begun, all symptoms cleared up, and the spinal fluid showed 24 lymphocytes, a negative Wassermann reaction but a positive gold curve.

This patient was last seen on November 21, 1939, about eleven months after he first came under observation. He still had a foul discharge from his left ear. Hearing was completely gone, and no response could be elicited from irrigation of the ear with ether.

These two cases had certain points of similarity. They both had dead labyrinths, and in both the spinal fluid cell count was elevated above normal. The first patient had no discharge from the middle ear, yet developed a mastoid suppuration. This infection eroded the cortex and the posterior canal wall.

DISCUSSION

DR. M. A. GLATT: It is often difficult to differentiate clinically the serous from the purulent type of labyrinthitis or to foretell whether the pathologic process in a latent type is fibrosed or is lingering.

In the first case, in view of the improvement in symptoms and decrease of spinal fluid cells, it appeared that recovery might take place and conservative treatment was justified. On the other hand, when one considers the late onset of the labyrinthine symptoms in an acute middle ear suppuration with an intact ear drum, followed by an atypical form of mastoiditis, then one realizes that the prog-

nosis was grave, and may assume that probably an earlier exploration of the labyrinth was indicated.

The second case is an example of the circumscribed type which gradually progressed into a latent form of labyrinthitis. The history of a chronic ear discharge and the mild recurrent attacks of labyrinthitis offered a better prognosis. The delay in performing the mastoid operation was due at first to the acute exacerbation of the otitis, then to the discovery of an associated syphilitic infection and because of the patient's refusal.

At the time of operation, the management of the labyrinth depends on the findings. If intact, it should be left alone. Should signs of meningeal irritation arise postoperatively, immediate exenteration of the labyrinth is indicated. However, when it is found that the cholesteatoma has invaded the labyrinth capsule, or when the removal of granulation tissue will uncover the labyrinth, then the latter should be exenterated at the same time.

The conservative or the radical management of a particular case of labyrinthitis depends on many factors associated with the case, such as the etiology, the history of trauma or infection, whether there is associated acute or chronic ear suppuration, the condition of the mastoid and the contiguous structures, particularly the bony labyrinth at the time of operation, and the findings of the cerebrospinal fluid.

DR. HANS BRUNNER: I have not seen this case and can speak only about labyrinth operations in general. When I began the practice of otolaryngology many labyrinthine operations were being done. Later on the number decreased and in the last years sometimes many months passed without one being done in our clinic. This decrease in the performance in labyrinth operations is not limited to my own experience. We must bear in mind the fact that there is a difference in the development of a chronic otitis and of a chronic labyrinthitis. A chronic otitis media is progressive as long as it is present. The tendency for spontaneous healing is but little marked when the bony walls of the ear are affected. This is not true with labyrinthitis, which has a great tendency to heal spontaneously even when tuberculosis in other organs is present. Consequently, chronic labyrinthitis does not call for surgery. Since acute labyrinthitis is also not a surgical condition, we may say in general that chronic as well as acute labyrinthitis *per se* are not surgical.

It is a matter of personal choice whether or not one operates on a labyrinth, but there is no question as to the necessity of per-

forming a labyrinth operation when the labyrinthitis is complicated. The signs for such developing complications are: fever, changes in the eye grounds, blood count and spinal puncture. In such cases a thorough labyrinth operation must be performed with the approach from posterior fossa.

In Dr. Pollock's first case the labyrinth operation was indicated because the patient had an elevation of temperature. In the second case whether or not a labyrinth operation should be performed cannot be answered positively but the operation would seem to me to be indicated.

Unusual X-ray Studies

J. H. GILMORE, M.D.

(Abstract)

The following roentgenograph studies of unusual skull conditions were shown, obtained from 3,580 sinus examinations and 1,671 mastoid examinations at the Illinois Eye and Ear Infirmary since July 1, 1933.

Case 1. Mucocoele of an eccentrically lateral lying fronto-ethmoidal cell which had eroded into the orbit.

Case 2. Large osteoma occupying the entire left anterior ethmoidal region.

Case 3. Large osteoma of the antrum completely filling the sinus and involving the superior maxilla.

Case 4. Rhinolith forming a complete cast over one inferior turbinate.

Case 5. A giant cell tumor of the mastoid demonstrating the difference between neoplastic and inflammatory bone destruction by roentgenographic appearance.

Case 6. A large cholesteatoma of the mastoid demonstrating value of Towne's position as an aid in such diagnoses.

Case 7. Suppuration of the petrous apex observed in the Taylor position with subsequent examination demonstrating sclerotic repair.

Case 8. Syphilitic osteomyelitis of the skull on a congenital basis in a woman aged 24, demonstrating almost complete damage repair two years after treatment.

**Experiences With Endaural Complete Mastoidectomy
and Attico-Mastoidectomy**

ROBERT HENNER, M.D.

(Abstract)

The purpose of this report is to discuss some experiences since April, 1939, during which time thirty-nine endaural procedures were performed. Of these there were sixteen simple or complete mastoidectomies, two modified radicals or attico-mastoidectomies, twenty cases of radical or mastoido-tympanectomies, and one case of fenestration operation for otosclerosis.

The stages and procedures involved in the operations were discussed briefly.

Sixteen simple or complete endaural mastoidectomies were performed. The ages ranged from 3 to 60 years of age. Their average postoperative stay was eleven and one-half days. There were four sub-periosteal abscesses, four tip abscesses, two cases of extensive retro-sinus necrosis, and one case of extradural abscess in the zygomatic area. In this case the patient, a boy aged 8, had marked zygomatic swelling, temperature of 104 degrees, and was quite toxic. During the mastoidectomy, on exposure of the zygomatic cells, about a half ounce of yellow, creamy pus gushed forth under pressure. Dural granulations were exposed and cleaned, and because the squamosal portion of the temporal bone about this area appeared necrotic, a portion of bone 5.5 cm. in diameter was removed. This patient had an uneventful postoperative course and left the hospital on the thirteenth postoperative day. Two cases of perisinus abscess were operated with granulations on the sinus. No cases of lateral sinus thrombosis were seen. However, in one routine simple mastoidectomy, the lateral sinus was accidentally perforated while skeletonizing the sinus plate. The hemorrhage was controlled with a small pack, and the surgery was completed through the endaural window without difficulty. The postoperative course was uneventful, and the temperature never rose over 98.8 degrees. One patient, aged 60, developed bronchopneumonia on the eighth postoperative day. This was followed by an erysipeloid infection about the operated ear, which responded to sulfanilamide and the patient was discharged on the thirty-third postoperative day. In one case of post-auricular fistula, a revision of the mastoidectomy was performed endaurally, and the sinus tract was everted, but the primary suture of the fistula sloughed; however, it did heal by secondary intention.

In another case, within two days postoperatively, an edema developed over the zygoma. This subsided, but immediately granulations began to spring up in the external canal, and at present the entire canal is stenosing. This occurred as a result of accidental perforation of the posterior membranous canal. This case is about five weeks old postoperatively. A plastic will be done on the canal at a subsequent date. The remainder of the cases were the usual coalescent mastoids.

In considering the external ear following the endaural complete mastoidectomy, the results are satisfactory. Occasionally, where healing has been slow, a small antauricular scar may be observed. There have been no cases of perichondritis, collapse of the canal or stenosis, other than the case described. The endaural approach in the complete mastoidectomy can be performed by an experienced operator so every type of mastoid pathology can be dealt with adequately. Further, this approach preserves the principle of wide open drainage and permits daily inspection of the mastoid cavity. Since healing occurs from the bottom out, there is no necessity for constant probing to the antrum, nor is there sealing off of a wound infection. The postoperative course in these patients has been free of any serious morbidity. Another point to consider is that delayed healing and retro-auricular fistula offer no problem, as they do in postauricular surgery. Also, since the attachments of the sternocleidomastoid muscle are uninjured there is little postoperative pain in the neck. The differential diagnosis of meningitis is therefore more easy. The only practical difficulty encountered has been that in a few of the early cases, particularly where there was edema of the skin, tip exposure was difficult.

Experience thus far with the attico-mastoidectomy shows that the endaural operation for the attico-mastoidectomy or modified radical is a procedure of great merit.

Observations on the Endaural Mastoidotomy of Lempert

GEORGE WOODRUFF, M.D.

(Abstract)

In this series the attempt has been to do a complete mastoidectomy and to follow Lempert in his removal of all tissue in and about the middle ear which might harbor disease. The results to date are encouraging.

The incisions are more difficult than is the postauricular incision, especially for a novice. Their execution demands thorough knowledge of the descriptive details plus a practical knowledge of the anatomy of the membranous and bony canal walls. Adequate practice on the cadaver is necessary to overcome these difficulties.

With a little practice one is able to work well through the space afforded by the endaural approach. However, it should be emphasized that a good working knowledge of surgical anatomy and practice on the cadaver are even more important than in radical surgery by the usual route.

After the completion of the simple mastoid, Lempert's method was followed in his thorough work in and about the middle ear. First the posterior canal wall is lowered to the level of the facial ridge and the ridge is further brought out by thinning the canal wall from both the canal and mastoid sides. The bridge of bone is removed by inserting the perforating bur beneath it and burring gently outward. The external wall is removed up to the level of the skeletonized dural plate of the middle fossa and forward flush with the sloping anterior wall. The annulus tympanicus is removed anteriorly, inferiorly and posteriorly and the anterior wall of the middle ear is thinned, thus bringing into view the mouth of the tube, the hypotympanum and the region of the stapes and oval window. The hypotympanic cells are thoroughly broken down until the floor over the jugular bulb is smooth and the promontory well outlined. The processus cochleariformis is fractured and removed, and the tensor tympani muscle evulsed, and any cells about the opening of the tube are curetted out. When necessary the floor of the canal is lowered enough to give a good view of the hypotympanum.

No very serious complications have been met and none that could be charged to the technic.

Seventeen of these cases had been diagnosed as uncomplicated cases of chronic purulent otitis media. Of the others, one had a diffuse purulent manifest labyrinthitis. He was hospitalized for three weeks and when all active symptoms had subsided the operation was performed. A fistula was found in the horizontal canal. The postoperative recovery was uneventful. Today his ear appears to be dry, but there is considerable narrowing deep in the canal, though an applicator easily passes through it.

Another had a diffuse serous labyrinthitis, the symptoms of which disappeared after rest in bed. An endaural mastoidotomy was performed sixteen days after admission. At operation

a fistula was found in the external canal. The convalescence was uneventful except that there was considerable difficulty in keeping the canal from becoming constricted.

In the third a diagnosis of circumscribed labyrinthitis was made. Recovery was without any untoward incident.

In two patients the present condition is unknown. Two others have been operated upon too recently to judge the result. Of the remaining sixteen, eleven have dry ears and five have varying degrees of discharge. In general the healed cavities are much smaller than those found after the usual radical, and the epidermis is considerably thinner and seems to have loss of tendency to desquamate.

In some cases there has been difficulty in controlling the healing process. This is especially true when the after care was given by someone not experienced in radical mastoid cases. In some instances the middle ear appears to have become obliterated and in a few considerable constriction of the canal has occurred; in one or two a false membrane has formed across the canal.

No special claims are made for this operation or for the results. The presentation is given as an example of the results obtained after a fairly good trial of the Lempert endaural mastoidotomy.

Some of the advantages are that a better view of the middle ear is afforded than is obtained in the usual operation. However, the postauricular radical operation can be modified to give approximately the same view. The canal incisions are included in the initial incisions and afford a good view of the middle ear and canal region throughout the whole operation. There is no plastic work to be done on the canal and no sutures necessary at the end of the operation.

These patients have less postoperative pain. They can usually be out of bed earlier and are able to leave the hospital one or two days sooner. The soft tissue covering of the postauricular area is not weakened and there is little likelihood of retro-auricular fistula.

The disadvantages are difficulty of the incisions and the necessity of working in a smaller field.

Whether or not to adopt the endaural route for mastoidotomy must be decided by the individual operator. A surgeon who is not willing to perfect himself in the method by work on the cadaver should probably continue with the postauricular route.

Perhaps the most valuable by-product of Dr. Lempert's work in the perfection of his various endaural procedures, especially of course the fenestration operation, is the reawakening or rebirth of interest in otologic surgery. He has done more to stimulate knowledge of the surgical anatomy of the temporal bone than anyone has done for decades.

DISCUSSION

DR. GEORGE E. SHAMBAUGH, JR.: I have used the endaural approach for all radical mastoidectomies and for some simple ones for a year. For the simple mastoidectomy I am not sure the advantages are very great. For radical mastoidectomy I think eventually the endaural will replace the postauricular approach. Operation is done via a route where the cavity has to be kept cleaned and that means that it will be accessible for future care. It is important that the incision be kept wide open until epithelization is complete. With the postauricular operation I have had a perichondritis of the auricle develop in two cases. I think the endaural approach will obviate this complication since the incisions are entirely extracartilaginous.

DR. THOMAS C. GALLOWAY: For about a year and a half we have been using this operation rather frequently at Cook County Hospital. My conclusions are much the same as Dr. Shambaugh has given. One can do a simple mastoidectomy endaurally but in the presence of a lateral sinus suppuration or sometimes a subperiosteal abscess it is sometimes more difficult to reach all areas of disease, and I feel rather sure that the occasional operator doing simple mastoidectomy will do better if he uses the classical approach.

I think the presentations of Drs. Henner and Woodruff deserve a lot of credit, because these demonstrations lead to much more refinement in technic and anatomy.

For a modified radical one can hardly imagine a finer technic than this operation offers. As we develop this technic we are going to do more operations without sacrificing the contents of the middle ear. However, there are difficulties. In our first series of cases, because we did not carry our incision high enough and did not get a very good exposure, we got some stenoses of the canal. Now they rarely occur.

DR. JOSEPH BECK: Some of the men present have used the electro-trephine burr; Dr. Boettcher, who is one of the pioneers, used it for mastoid surgery. That instrument is now being used,

and in teaching its use one should be taught as well the anatomy of the temporal bone. Dr. Lempert has been working on this method for many years and many men throughout the country have followed him. We will hear a little later of the possible complications. Dr. Shambaugh brought out a very important point about perichondritis. If you do not have any difficulty with the cartilage in the postauricular operation, in the acute mastoid, I should say you would have more difficulty by the endaural route. In the cartilaginous part of the canal and in a very virulent infection I think the chances are greater for infection in the neck than with the incision in the retroauricular method. We have still to await results in acute mastoiditis as to what this operation will bring.

For the semi-radical operation that Dr. Henner reported, I think it is an excellent approach and will give better results and a better method of after treatment than with the old method. Why should it be different in this operation in the formation of epithelial debris, because the cavity will become lined with some type of modified epithelium as in the radical operation when done by the postauricular approach?

A very important point not dwelt upon by the discussors is the eustachian tube. I have seen some cases operated by this method, and there is a better approach to the tubal cells and a subsequent closing off of the eustachian orifice. I can show no case in my experience of radical mastoid which does not have to have an occasional cleaning out of the debris which forms in the cavity. If this method will reduce that to the point where there is a smaller cavity or a reformation of bone, and if some of these cases come to the postmortem table for some other reason than an ear condition, the temporal bone will be found healed. We are looking for such proof of what the Lempert operation will do.

DR. SAMUEL SALINGER: I wish I could share the enthusiasm of the essayists with regard to the use of the endaural method, even admitting a number of points wherein the endaural approach is superior to the retro-auricular. When I think of the history of endaural mastoid surgery (it goes back to 1875) and consider the vicissitudes through which it has passed and the critical examination to which it has been subjected in all European centers, having been tried and then generally abandoned, I cannot help but feel that it has been taken up on this side with perhaps too much enthusiasm. Babbitt in Nelson's Loose Leaf Surgery gives an excellent resumé of the history of this procedure. It would be very instructive to those

who contemplate taking up this operation to read the reports of Thies, who reported 1,500 endaural cases with only one failure and one fatality. Yet, when it was taken up by Van Eiken, he admitted later that he had to give it up. Other men tried various modifications of this approach and most of them finally abandoned it in favor of the retro-auricular approach, particularly in acute cases. There is one thing I cannot understand in the technic of the endaural radical mastoid. When we do a postauricular radical mastoid, we are particularly careful to preserve the membranous canal for our plastic. In the operation under discussion they remove a great deal of this same tissue and discard it, the dehiscence then filling in with scar tissue. I admire the enthusiasm of the essayists and believe that their report will stimulate interest in the technic as well as a more intimate knowledge of the detailed anatomy of the middle ear. However, if they mean to convey the impression that the endaural approach should supplant the retro-auricular approach, I should take issue with them, particularly in relation to the acute cases. One of the essayists mentioned that in the endaural approach your cavity epithelizes from the bottom up. This is a distinct disadvantage as compared to the retro-auricular operation where the drainage is naturally at the most advantageous point, namely, the lower end. On the other hand, if the endaural approach is employed in a sclerotic mastoid where there are no mastoid cells and where the object is to clean out the mastoid antrum and middle ear, I can see that this method will save the patient a great deal of pain and discomfort.

DR. M. A. GLATT: It has been stated that the endaural approach is suitable in the radical mastoid operation, but it has no advantage over the postauricular approach.

I have performed all my radical mastoidectomies by using Stacke's method of approach, that is, by taking down the posterior canal wall at a sufficient depth, which easily exposes the mastoid antrum. One thus obtains a very small cavity which does not require long postoperative care and does not leave any postauricular depression.

The fact that the endaural approach produces much cleaner cavities may be because a large portion of the membranous canal that bears hairs and ceruminous glands is discarded, which eliminates desquamation which would otherwise take place. The epidermis that covers the new cavity is better nourished because it advances over a thick layer of granulation tissue. This feature can be easily duplicated in the postauricular approach. To become pro-

ficient with the endaural method requires many hours of training in the use of a dental drill and the various sizes of burrs. The smaller the burr the more dangerous it is. In the endaural method one works mostly with small sized burrs. It is therefore difficult to introduce it as a routine method to our interne staff.

I can see its advantage as a step forward in the surgical treatment of otosclerosis or petrositis, and as such it is to be encouraged.

DR. GEORGE WOODRUFF (closing): Dr. Shambaugh and Dr. Galloway appear to hold substantially the same opinions that we do on the operations under discussion.

This presentation of cases has been made to give you an idea of the results we have obtained using the endaural approach. We are not attempting to say that these methods should be universally adopted. At present we are more favorably impressed with the endaural route for mastoidotympanectomy and attico-mastoidectomy than for complete mastoidectomy. Our results in mastoidotympanectomy since adopting this technic are undoubtedly greatly improved. However, we intend to go on doing all mastoid surgery in our service through the endaural route at least until April 1, 1940, which will make a period of over one year during which all mastoid surgery, with the exception of two cases, has been done by the endaural route. I believe that Dr. Henner and I both hold the opinion that the advantages of endaural mastoidotympanectomy and endaural attico-mastoidectomy definitely outweigh the disadvantages. Concerning complete mastoidectomy we prefer to reserve our judgment until we have had more experience. We have found it somewhat more difficult to perform some of the steps of the complete mastoidectomy through the endaural route than through the postauricular route.

In this series of cases we had had no perichondritis. The after care is of course important. The dressings should be done with the usual sterile surgical technic. After the first four or five days dressings and bandages are left off and the patient wears only a pledget of sterile cotton in the meatus. He is instructed to change the cotton every hour, always throwing away the first piece and putting the second one in the meatus. Because of this rather meager dressing, it seems that infection of the wound edges might easily occur. However, unless one case of erysipelas can be ascribed to this source, we have had no such trouble.

Dr. Beck mentioned that in one of our cases which he examined the eustachian tube was definitely closed. I do not know in how

many we have obtained this result, but I believe that if the Lempert technic is thoroughly followed the tube will close in a high percentage of cases.

Dr. Salinger talked about the history of the operation. We know that some mastoid surgery was done many years ago by several different men through an endaural route. Just what technic they used and how extensive the work was in the temporal bone, I am not prepared to say. I feel quite sure, however, that the temporal bone surgery was of quite a different type than that done by Dr. Lempert. Of course, the use of the finely controlled dental burr and modern currettes are a great improvement over the more clumsy instruments of an earlier period.

Dr. Glatt mentioned the point that in the radical operation by the Lempert technic a fair sized piece of skin is discarded. In one of our cases, by slightly modifying the incisions, this skin was saved. This can be done easily but from our experience to date we question its advantage.

It was mentioned that the cavities in our cases of mastoido-tympanectomy are smaller than those seen after the usual operation. We do a thorough exenteration of the mastoid and have a large cavity when we stop the operation. Instead of trying to maintain a cavity of that size we allow the mastoid operation to granulate in to a large extent and then become epithelialized. Therefore, we do not have very large cavities. We are not always able to control this healing process as we would like, but for the most part we are pleased with the results.

Epithelialization takes place from the edges of the canal skin. The new epithelium seems to be of a different type than that seen following many radical operations in which flaps are turned in. It appears to be thinner and apparently has less tendency to desquamate. Of course, the smaller cavity is of some advantage in affording less chance for desquamation and collection of the resulting debris.

Dr. Boettcher, who was one of the first men, at least in this area, to use the burr, brought up the question of instruction in the use of the burr. I agree that residents should have instruction and experience in the use of the burr before using it in operations, though I do not feel that it is a hard instrument to use. Our residents have an opportunity to obtain some of this experience on the cadaver, thus combining their experience in the use of the burr

with practice in the actual procedures they will be called upon to perform.

The exposure of various areas of the mastoid cavity is facilitated by two maneuvers. Dr. Lempert emphasizes the point that the endaural window is mobile and can be shifted about to different points over the mastoid area. I have been able to do this to some extent, but I also want to mention that turning the head is also a great aid in reaching the various areas to be dissected. A good assistant holding the retractors properly has almost complete control of the head, and by shifting the window and turning the head, he can greatly facilitate the operation.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL
SOCIETY

Meeting of Monday, January 8, 1940

THE PRESIDENT, DR. GEORGE T. JORDAN, IN THE CHAIR

Laryngocele Ventricularis

J. R. LINDSAY, M.D.

(This paper appears in full on page 661 of this issue)

DISCUSSION

DR. FREDERIC E. TEMPLETON: The tomograph, laminograph or planograph are names applied to instruments which, by means of roentgen rays, project planes of the subjects being examined onto films, obliterating planes above and below by relative motion. Their superiority to good quality stereoscopic films is yet to be proved in determining the location and exact nature of certain structures. One of the best examples of their use is in the anteroposterior projection of the larynx, in which the dense shadow of the cervical spine is obliterated.

A simple adaptor for our regular x-ray table was devised at very little cost. A metal plate is bolted or fixed with wing nuts in an upright position to the side of the filming table. The plate contains a slot or a series of holes spaced one centimeter apart which run in a longitudinal direction through the plate at right angles to the table top. A bolt which swivels on a metal block is passed through the groove, or one of the holes, and is fixed in a position by a wing nut on the medial side. The swiveled metal block, fixed on the lateral side or outside of the metal plate, contains a smooth hole through which runs a rigid rod. This part of the apparatus is known as the fulcrum. The lower end of this connecting rod runs through a slot in another swiveled block which is fixed to a Potter-Bucky grid at the same height and in a direct line to the transverse center of the film as it lies in a Potter-Bucky grid tray. The upper end of the rod is firmly fixed to the tube; any movement of the apparatus keeps the central ray of the tube directed along a plane which runs through the rod. In this way, with the tube over the

exact center of the film, with the rod in an exact vertical position and with the fulcrum firmly fixed to the table's edge, the center of the beam is always directed on the center of the film. The drive is furnished by pulling a cord attached to any of the movable parts, preferably the tube carriage, which moves a short distance along its supports when the apparatus is in motion.

An automatic drive can be devised with additional expense. A strong string can be fixed to the movable tube carriage at one end and anchored to some fixed part at the other end. The carriage is then cocked by moving the carriage so that the spring is on a stretch. It is held in position by a magnetic release, which is electrically wired parallel with the grid release magnet. An oil chamber, attached to the carriage, will give smooth, even movement in addition to allowing an accurate control of the speed of movement.

In using such a machine, the level of the plane desired is obtained by moving the fulcrum up and down to the desired height above the table surface. It must be remembered that all criteria for good images which apply to the making of ordinary films apply to this instrument. In addition, other factors enter. Two of these are the absence of any play in the movable joints and the rigidity of the connecting rod. If any play is present, the effect will be the same as if a tube is violently shaken while making ordinary films.

We do not claim that the results obtained with such an instrument will equal those of any of the commercial machines, but if properly constructed it will give satisfactory service.

DR. JOSEPH C. BECK: Some years ago, a small group of us used to meet each month to talk over our troubles and failures. At one of these informal meetings Dr. Freer was present when Dr. Shambaugh told of a case of prolapse of the laryngeal ventricle he was going to operate upon. This patient had a tumor which appeared on the side of her neck whenever she gave singing lessons. Dr. Freer took great exception to the operation, from the standpoint that the procedure Dr. Shambaugh and Dr. Lewis had planned would ruin her economic voice, which was an essential physiologic structure for this woman who had become accustomed to using her voice in the presence of the prolapse. The operation was performed, and was reported several months later as being successful. Some time later at a joint meeting with the Surgical Society, this case was again reported by Dr. Freer as not being successful because the scar gave way and the prolapse recurred.

I was much interested in Dr. Lindsay's radiologic demonstration. It seems to me that if it is to be complete, and especially as it refers to the work of Negus, it should be supplemented by moving pictures of x-rays. I have seen recently a wonderful picture showing the x-rays of an individual chewing, as photographed from a fluoroscope.

Vertebral Caries in Retropharyngeal Space Infections

G. H. SCOTT, M.D.

(Author's Abstract)

The retropharyngeal space lies posterior to the pharyngeal musculature and is limited anteriorly by the deep cervical fascia and posteriorly by the prevertebral fascia. Medially it is divided into right and left compartments by the median raphe. Laterally it is separated from the pharyngomaxillary space by the thin alafacia.

Pus in this area usually remains localized to the pharyngeal region but may descend along the fascial planes overlying the longus colli and scaleni muscles to present as an abscess in the posterior triangle or even in the axilla. In some instances the infection follows on downward into the posterior mediastinum.

Retropharyngeal abscess may be acute or chronic. Vertebral caries is more commonly seen as the cause rather than the result of chronic retropharyngeal abscess.

In the acute form of the disease palpation of the pharynx or even depression of the tongue may produce an alarming interruption of respiration or cause a fatality. Lateral x-ray of the neck is a safe and reliable diagnostic method. It at once reveals the extent of the soft tissue abscess as evidenced by an increase in the width of the retropharyngeal space. At the same time it will reveal the presence of vertebral caries should such a condition exist.

The cases presented demonstrate clearly the following conditions:

Case 1. Acute retropharyngeal abscess occupying almost the entire cervical region. Depression of the tongue in this case produced alarming respiratory difficulty. The abscess was drained externally under local anesthesia. General anesthesia would have

increased the hazard. Although good drainage was established externally, the retropharyngeal swelling did not subside entirely. This necessitated incision of the abscess by the oral route as well. Pus under great pressure shot out of the mouth when the incision was made.

Case 2. Chronic retropharyngeal abscess of three months' duration. It was incised through the mouth and straw-colored fluid obtained. The Wassermann and Kahn tests were strongly positive. Diagnosis, pharyngeal gumma.

Case 3. Chronic retropharyngeal abscess of three months' duration which had been mistaken for a cyst and had been injected with iodized oil some six weeks before the patient had come to the clinic. As shown by x-ray, the iodized oil descended to the posterior mediastinum, but the abscess remained localized in the retropharyngeal space. The abscess was incised intra-orally but recurred and subsided only after diseased tonsils were removed.

Case 4. Chronic retropharyngeal abscess unrecognized for several months as evidenced by x-rays which had been taken four and one-half months prior to admission. The pus had presented bilaterally in the posterior cervical triangles. X-ray taken on admission showed early erosion of the cervical vertebrae without destruction of the intervertebral discs. This is in sharp contrast to Case 5, which is cervical Pott's disease with retropharyngeal abscess. In this instance the collapse of the intervertebral disc is an outstanding feature. The destruction of the intervertebral discs is even better shown in Case 6, also a cervical Pott's disease.

The erosion of the vertebrae continued in Case 4 even though through-and-through drainage was established in the neck. A posterior mediastinitis developed and was drained through the back. The patient died of pulmonary embolus. All tests, including guinea pig inoculation, failed to reveal any evidence of tuberculosis. This case is obviously one of vertebral caries secondary to a non-specific retropharyngeal space infection.

DISCUSSION

DR. ARTHUR PROETZ: I do not know when I have seen such an instructive series of patients as those just presented, or such an instructive series of radiographs. It occurred to me while Dr. Scott was talking that it would be extremely useful in interpreting the advancement of these infections and the behavior of some of these

swellings, if we differentiated between the retropharyngeal and the prevertebral spaces, as we should. As a matter of fact, in the textbooks anatomists almost never do so, or if they do, it is merely in passing. However, the spaces are quite distinct. The fascia which separates them is quite thin and quite tough. The retropharyngeal space stops at the carotid sheath, whereas the prevertebral space spreads clear around to the side and peters out where the nerve roots come out, and this may have something to do with occipital headaches and rigidity of neck muscles. The longus colli and longus capitis muscles lie within this space and the roots of the brachial plexus are in contact with it. The muscle attachments to the skull and the atlas, respectively, constitute the upper delimitation and the lower is the upper margin of the mediastinum. The case Dr. Scott mentioned in which he opened the abscess through the neck externally, and found after a day or so that the drainage was not sufficient, indicates that the retropharyngeal space was drained and the prevertebral perhaps only buttonholed. When it was opened through the pharynx, the space was reached and proper drainage accomplished.

The radiograph of the case in which lipiodol was injected shows this space very beautifully. As you saw, the lipiodol lay close against the vertebral column and did not fill the whole abscess cavity. The tough membrane is very often the thing that prevents the abscess from draining and is the determining point between drainage and extension. I have seen in one case at autopsy, infection of the digastric space through perforation of the mastoid tip. The infection invaded the prevertebral space, broke down the attachment at the midline, went up on the other side through the foramen magnum near the vertebral artery, formed an abscess there, and killed the patient.

The existence of these two spaces is not theoretical. If the cadaver is sagittally sectioned a little to one side of the midline and a stream of compressed air is allowed to play over the sectioned surfaces for a few moments, the spaces lay themselves open and show very definitely how infection may appear in one space without invading the other.

DR. G. H. SCOTT (closing): I wish to thank Dr. Proetz for his intelligent discussion of this subject. His distinction of the prevertebral and retropharyngeal fascial spaces offers an explanation as to why the injected lipiodol descended into the thorax while the pus lying anterior to it in the retropharyngeal space remained localized in the pharyngeal region.

The Eustachian Tube: Abnormal Patency and Normal Physiology**H. B. PERLMAN, M.D.**

(Author's Abstract)

While a great deal of treatment is directed to the eustachian tube, our knowledge of its functions, and methods for determining this, have been remarkably static for the last half century.

One can learn a great deal about eustachian tube function by studying the patients with the syndrome usually referred to as the continually open eustachian tube. A motion picture was shown of a thin, atrophic drum moving synchronously with respiration in a patient with an open eustachian tube. A careful adjunct in studying these cases as well as other otologic conditions involving the eustachian tube is the use of a simple quantitative method for studying eustachian tube patency. This method chiefly entails the use of the ordinary wall manometer of a blood pressure apparatus. Definite minimal pressures for inflating the normal tube by Valsalva's maneuver were established for this method. A great decrease in this pressure was found in the group of patients with the open eustachian tube when the tube was temporarily closed and the patient free of symptoms. It was found that the reclining position greatly increased the resistance of the tube in the normal as well as in the subjects with the open eustachian tube and in patients with suppurative ears so that the greatest pressures that the patient could produce were inadequate to open the tube. Exercising decreases the resistance of the tube in the normal individual and in those with suppurative ears. The presence of abnormal patency of the eustachian tube was found in subjects that had a motor fifth nerve involvement following a retrogasserian neurectomy. New experimental equipment used to study eustachian tube function and the records obtained were briefly described and illustrated by lantern slides.

In conclusion a motion picture was shown of movement of the eustachian cushion in the human, taken through a large defect in the hard palate when the subject was forming the sound "ah", and when swallowing.

Cranial and Intracranial Complications of Acute Frontal Sinusitis

PAUL C. BUCY, M.D.

AND

W. TRACY HAVERFIELD, M.D.

(Authors' Abstract)

Three cases of acute frontal sinusitis which developed immediately following swimming were presented. In the first an extensive osteomyelitis of the right frontal bone and an abscess of the right frontal lobe developed. The patient was admitted two and one-half months after the onset in a semi-comatose state. Drainage of the abscess and removal of the osteomyelitis in three stages resulted in recovery though vision was rather seriously impaired. In the second case a right frontal sinusitis appeared immediately after swimming. This was soon complicated by an osteomyelitis which was quickly relieved by extensive extirpation one month after the swimming. There were no intracranial complications. In the third case a left frontal sinusitis appeared following swimming. Though no osteomyelitis developed, an abscess of the right frontal lobe soon developed. This patient recovered following drainage of the abscess about three months after the swimming.

A fourth case was presented in which a localized osteomyelitis along the course of the left anterior temporal diploic vein developed following an abscess beneath the left temporal muscle. Shortly thereafter an abscess developed in the right cerebral hemisphere beneath the central region.

Using these cases as a basis for discussion it was pointed out that:

1. Extension of the infection from the sinus is usually via the frontal and anterior temporal diploic veins to the frontal bone, thence intracranially through small emissary connections into the superior sagittal sinus and down one of the connecting veins into the cerebral hemisphere of the same or opposite side.
2. Prophylactic measures must be directed toward prevention of the sinusitis itself as well as spread of the infection beyond the sinus.
 - a. The development of sinusitis as a result of swimming can be in some measure prevented by proper breathing, proper diving, the use of nose clips, and the avoidance of chilling.

b. The avoidance of spread of the infection from the sinus once a sinusitis has developed may be attained by prompt, adequate, external drainage of the sinus in those patients who develop local pain, tenderness and swelling over the sinus associated with fever, following swimming.

3. All acute osteomyelitis of the skull should be treated by wide excision of the infected bone as soon as the diagnosis is made. It is not possible to rely upon the roentgenograms for diagnosis if prompt treatment is to be instituted, as they do not show change until 10 or 20 days after the onset of the infection of the bone. The diagnostic sign of the development of this complication is an edema of the forehead spreading upward from the sinus.

4. Abscess of the brain should be treated by prompt aspiration and drainage with careful attention to the protection of the meningeal spaces from infection by obliterating them about the field and not operating through an infected field.

5. The bony defect resulting from extirpation of the osteomyelitic bone is usually spontaneously repaired by regeneration of bone.

DISCUSSION

DR. THOMAS GALLOWAY: Dr. Bucy gave a most illuminating discussion, especially as to the distribution of the diploic veins. One assumes that most cases of brain abscess Dr. Bucy has had are more chronic than the ones seen in otolaryngologic practice, which raises the question as to the time of operation on brain abscess. Should one wait for localization? We now have a boy, who had a history of a cold twelve days before, who came in with a perforating frontal sinusitis. We did a simple drainage at the external angle and at the internal angle with trephine of the sinus, and got considerable pus under pressure. In three days he had a crossed arm weakness and a crossed facial paralysis. His general condition was good. We did a Killian operation in order to expose the dura and it was glistening and smooth. Eight days after the apparent onset of frontal sinusitis, the first localizing symptoms, really suggesting intracranial complications, were seen. Today he is sluggish mentally, he does not answer questions well, and there are 106 cells in the spinal fluid. What would Dr. Bucy do in such a case? As to frontal sinusitis, I think most rhinologists believe that early operation, if it cannot be avoided, should be limited to as little as possible, and we think we see more cases develop complications from early operation than cases in which

complications are prevented by early operation. We have tried to avoid interference during the first seven days if it is possible.

DR. T. E. WALSH: I would like to emphasize what Dr. Bucy said about interference with these cases when they become chronic, that is, where you have chronic frontal sinusitis with osteomyelitic changes in the bone. I recently have had a man with x-ray evidence of thickening of the bone of the periphery of the sinus and with definite evidence of clouding of the frontal sinus. We did a radical frontal operation and found the bone only slightly roughened along the lateral margins of the supra-orbital ridges. I made the mistake of not being radical enough. The patient developed osteomyelitis and I have had to remove most of his cranial vault. He is alive, I do not know why. When we operate on a case that is suspicious of osteomyelitis it is worthwhile to do a radical removal of the bone in the first operation. In general I am against radical surgery, but I think in these cases it is essential. I agree with Dr. Galloway that "hands off" for the first few days of an acute frontal sinusitis is best. I find that if we interfere surgically with acute frontal sinusitis we are apt to get into more trouble than with conservative treatment.

DR. FRANCIS LEDERER: Someone else might have given this same presentation from a different angle and reversed the order in which the cases came to the specialist. Conservatism in the early days seems to have been the usual thought from a rhinologic standpoint. Many of these cases discussed by Dr. Bucy have been shown to illustrate the result of too early surgical intervention. How does one know when to interfere in cases of this kind? You can find in your own practice and in the literature just as many instances where you can say that complications such as brain abscess are due to early interference, as you can ascribe in Dr. Bucy's series to late interference. It is essential to distinguish two groups of osteomyelitis. One is a virulent, fulminating type (rapid or acute form), and the other is the type Dr. Bucy was mainly concerned with, viz., chronic (slow form) osteomyelitis. To my mind, therefore, they offered the positive good results which he obtained. I can well imagine surgically interfering with those cases when the puffy swelling appeared and have the same complication occur and attribute it to too early intervention. I still do not believe that you can stereotype the treatment of these cases and say positively that in all instances we must operate early, or that early interference will prevent this intracranial picture. I think judgment should be based upon the virulence or the chronicity of the condition. Further, I believe that most rhinologists agree that they do not like to go into an area of spreading

osteomyelitis too early. Clinical signs and roentgenologic investigation give no absolute index as to the microscopic spread of the process. One can very well understand that the process is constantly advancing one step ahead of your scalpel. When the condition has existed for weeks or months before the patient comes to surgery, one is in an excellent position to remove osteomyelitic bone and achieve the same results Dr. Bucy did. But, when the osteomyelitis is acute and just one step ahead of your scalpel, you have the feeling that the possible outcome is not quite as certain as one would be given to believe by his excellent results. The swimming problem is very important and worthy of the emphasis given by Dr. Bucy. We had at one time, three cases of osteomyelitis that followed swimming. I believe prophylaxis should be emphasized in combating this complication.

DR. JOSEPH C. BECK: Dr. Bucy commented on the loophole that Furstenberg left in his report as to regeneration of bone after skull operations. I would like to have Dr. Bucy say something about complications following the extensive removal of bone, such as epilepsy, etc. I am referring to a case of extensive osteomyelitis in a boy in whom a greater part of one side of the skull was removed. The patient made a splendid recovery, but he developed epilepsy. Several months after operation we studied the x-ray of the defect and found evident regeneration of bone, which one could also feel. The neurologic surgeon who was called in advised the exploration of this region for the cause of epilepsy. When he exposed this area I was delighted to see how much bone had regenerated to cover the defect. He removed some particles of this so-called bone and I have sections to show there was not one bit of bony structure in what the x-ray and palpation showed to be bone. It was very dense and calcified tissue but there was no real bone. We must differentiate between these two and I think it makes a difference as to what cover the brain has afterward. I would like to hear from Dr. Bucy specifically about that. Furstenberg, I believe, called attention to some of his cases that had Jacksonian symptoms.

DR. PAUL C. BUCY (closing): In reply to the first question, I do not believe that the infection spreads by way of dural vessels. I think we can see from these x-rays that it is spread by vessels between the two layers of bone within the diploe. As a matter of fact there are few vessels in the dura mater. The diploic veins do eventually pass through the dura mater, but I would hardly call them dural vessels.

As to the time of operation for brain abscess, this is a point on which I am in disagreement with many neurosurgeons. A year ago I published the results of seventeen consecutive cases with recovery in 70 per cent.* It has been my experience that the time to operate on a brain abscess is when you make a diagnosis, and that has been my practice. I have had cases operated on within twelve days after the earliest possibility of infection, which made a prompt and complete recovery. That is now common. Most cases are of considerably longer duration before operation, and I think there is undoubtedly a measure of safety in having a longer period elapse. There is no question but what more attractive operative mortality statistics can be obtained by waiting, as the patients with the more virulent rapidly progressive infections will then die before coming to operation. That is why McEwen had such excellent results. He was dealing in every case with a chronic, well-localized and well-encapsulated brain abscess. I am sure, however, that many of the more acute cases can be saved by prompt drainage and that the mortality for all cases of brain abscess can be lowered by such treatment, even though the operative mortality is raised.

As to operation upon the frontal sinus for drainage, I do not feel competent to say exactly what operative procedure you should follow. You are better judges of that than I. I am inclined to believe that the operation should be as limited as possible and yet achieve adequate drainage. Obviously, it is of no advantage if it does not.

I am familiar with Dr. Walsh's case and I am sure he should be complimented on still having the case. It has been an extremely difficult one and has been handled well.

As Dr. Lederer has said, x-rays similar to these have been shown in the past, and the osteomyelitis has been attributed to an operation upon the sinus, merely because it followed operation. Frequently that is an incorrect interpretation for, as we have shown here, such osteomyelitis does develop spontaneously as a result of acute frontal sinusitis which follows swimming. I have always looked upon chronic osteomyelitis as of much longer duration than in these instances. In the second case the entire history was only a month and the osteomyelitis was of two weeks' duration. In the other case the osteomyelitis had been present a little longer and was, therefore, much more extensive. I agree that there are two groups of osteo-

*P. C. Bucy: The Treatment of Brain Abscess. *Ann. Surg.*, 108:961-979, 1938.

myelitis, the chronic localizing type and the diffuse spreading type, but am not able to tell which is going to develop, and it is my feeling that in every instance the osteomyelitis should be widely excised.

With reference to Dr. Beck's discussion: Although such complications as epilepsy do occur following osteomyelitis, they are not common, but following brain abscess convulsions are an extremely common, and a most unfortunate and disagreeable complication. Undoubtedly in such cases the convulsions are related to the scar formation which follows drainage of the abscess. It would therefore appear logical to treat such convulsions by removing the scar as one does in traumatic cases. Unfortunately, infection often follows an attempt to take out the scar. The scar harbors infection for months and years after all evidence of infection has disappeared. The same organisms have been recovered from the scar tissue years after the abscess has been successfully treated. Attempts to remove the scar have resulted in meningitis, and I think we have all quit trying to remove such scars. The convulsions which follow osteomyelitis alone are more difficult to understand. I have seen one case in which the subdural space was obliterated, the dura mater and pia-arachnoid membrane were adherent to the surface of the brain, and I feel sure that was the cause of the convulsions. As to regeneration of bone, undoubtedly there are cases in which only calcification develops, but I am sure Dr. Beck has seen many cases, as I have, where there has been a replacement of bone itself.

Abstracts of Current Articles

NOSE

The Use of Potassium Chloride in the Treatment of Allergic Conditions.

Spain, W. S., Wescott, F. H., and Gaillard, G. E. (New York), *J. of Allergy*, 11:393, No. 4 (May), 1940.

Twelve cases of non-seasonal allergic coryza and thirty-one cases of ragweed hay fever were treated with from 15 to 50 grains of potassium chloride daily. Sixteen of the ragweed cases had specific injection therapy in addition to the potassium chloride.

Of the fifteen ragweed cases treated with potassium chloride alone, twelve obtained no relief, and the remaining three obtained little, if any, relief.

Of the sixteen who had potassium chloride in addition to pollen injections, five were unchanged, four obtained immediate relief with a few bad days during the season, and five reported considerable relief. Two remained unimproved.

The authors conclude that potassium chloride gave disappointing results in hay fever and allergic coryza.

DEAN, JR.

Destructive Osteitis Fibrosa of the Frontal Sinus. (Osteite fibrosa destruyente del seno frontale.)

Ventura-Gregorini, F. (Milano), *Arch. di Otol., Rino. and Laring.*, 51:303-322 (June), 1939.

This article is essentially of histologic interest. A literary review of the subject includes an extensive presentation and discussion of each case thus far reported.

The author further points out the frequency of various tumors originating in the frontal sinus and the rarity of a destructive osteitis fibrosa primarily invading this sinus.

Ventura-Gregorini's case, in which cure was obtained, is reported in detail. Five photomicrographs and two roentgenograms accompany the article.

SCIARRETTA.

Evaluation of Roentgen Therapy in Sinus Disease.

Maxfield, J. R. Jr., and Martin, C. L. (Dallas), *Radiology*, 34:300, No. 3 (March), 1940.

The authors use a heavy dose (400 r) given as one dose. The eyes, brows, hair, and chin are shielded. The cases treated had failed to improve with conservative and surgical treatment.

The percentage of cases cured or improved was greater when treated in the acute stage and decreased in the chronic types. Cases with polyps were unchanged. Eight cases with less severe proliferative changes were cured or improved while one remained unchanged.

DEAN, JR.

A Voluminous Papilloma of the Nasal Fossa, Maxillary Sinus and Rhinopharynx.

(Sopra un caso di voluminoso papilloma della fossa nasale, del seno mascellare e del rinofaringe.)

Salvadori, G. (Messina), *Arch. di Otol., Rino. and Laring.*, 51:356-365 (July), 1939.

The author reports removing a large tumor mass which involved the anterior ethmoid cells, maxillary sinus, entire nasal cavity and the nasopharynx. It protruded into the oropharynx, blocked both choanae and completely blocked nasal respiration. This tumor was removed by a radical rhinotomy after Moure. The histological examination revealed a pure papilloma of cylindrical epithelium probably originating from the anterior ethmoid region.

The size and extent of the mass encouraged Salvadori to report the case. The patient, a farmer woman, single, and 40 years old, recovered and was in perfect health one year after the operation, when the report was made.

Salvadori gives a complete review of the literature, including one case of his own reported in 1928. He considers the classification of papilloma, benign or malignant type, as contended by some authors, to be erroneous and believes that the malignant papilloma is confused with cases of carcinoma manifesting papillary changes. He convincingly states that a pure papilloma is, clinically and histologically, a benign tumor and further affirms that if such cases, reported as papilloma, later manifest metastases or cause death, the histological examinations were not completely performed, and the tumors were early carcinomata.

SCIARRETTA.

Contribution on Diagnosis and Histogenesis of Plasmocytoma of the Nasal Fossae. (Contributo alla diagnosi e all'istogenesi dei plasmocitomi dell fosse nasali.)

Brunetti, F. (Torino), Valsalva, 15:141-161 (April), 1939.

The article contains a historical review and a classification of plasmocytoma. Two cases of malignant plasmocytoma are reported. A discussion of the histogenesis and metastasis of this type of tumors is accompanied by an extensive presentation of the pathogenesis.

SCIARRETTA.

LARYNX

Treatment of Chronic Hypertrophic Laryngitis.

Putney, F. Johnson, and Clerf, Louis F. (Philadelphia), Archives of Otolaryngology, 31:925, No. 6 (June), 1940.

The pathology and clinical picture of chronic hypertrophic laryngitis are presented along with a procedure of stripping the vocal cords to remove the redundant tissue.

The operation is performed through the direct laryngoscope under local anesthesia. Stripping is accomplished by the use of cupped forceps or biting forceps.

Eight cases have been treated with good results in all.

DEAN, JR.

MISCELLANEOUS

Prolonged Atelectasis of Both Foreign Body and Non-Foreign Body Origin.

Hart, V. K. (Charlotte, N. C.), Southern Medical Journal, 33:487, No. 5 (May), 1940.

Because he believes that the duration of atelectasis is directly proportional to the extent of change in the bronchial wall, the author urges early recognition of atelectasis followed by early bronchoscopic investigation and drainage. Six cases of atelectasis in children are presented and illustrated with roentgenograms.

DEAN, JR.

Contributions to the Study of Citelli's Sublingual Abscess. (Contributo allo studio dell'ascesso sottolinguale di Citelli.)

Giuffrida, E. (Catania), Arch. di Otol., Rino. and Laring., 51:293-302 (June), 1939.

The pathological anatomy of a localized abscess in the sublingual space was described in detail by Citelli in 1920.

Symptoms and differential diagnosis are explained principally to avoid confusion with Ludwig's angina, purulent glossitis and other acute inflammatory conditions of the throat and neck. A detailed presentation of the anatomy and topography of this space is accompanied by an extensive historical and bibliographic review. Six cases are reported. The etiologic factors and bacteriology are emphasized. Invariably surgical treatment is successfully accomplished through the floor of the mouth.

SCIARRETTA.

A Method of Repositioning the Mandible in the Treatment of Lesions of the Temporo-Mandibular Joint.

Pipkin, B. N., Moore, T. R., McCulloch, A. J., and Moore, S. (St. Louis), Washington Univ. Dental Journal, 6:107, No. 4 (May), 1940.

Repositioning of the mandible to re-establish normal condylar relationship is accomplished by the authors by the following steps:

1. Careful medical and dental history.
2. Accurate radiograms of condyles in open and closed positions. Exact reproductions are needed for follow-up. The lamina-gram is especially desirable.
3. Facial photographs and measurements. Also plaster casts gnathostatically articulated and photographed.
4. Specially-designed articulator with adjustments to accommodate predetermined condylar correction of plaster casts.
5. Headgear with elastic strap.

Cast cusps or splints are used to establish the fulcrum as determined by the above method. The headstrap is used to exert four pounds upward pressure on the mandible. Later proper dentures are fitted.

Three cases are presented in detail.

DEAN, JR.

Epinephrine Hypersensitivity: Report of Two Cases.

Cohen, A. E., and Waterstone, M. L. (Louisville), *J. of Allergy*, 11:393, No. 4 (May), 1940.

A review of the literature is given in addition to two case reports. Both cases were asthmatic negroes. One injected herself with epinephrine for six years before she noted that a swelling followed by necrosis would cause several unhealed injection sites to flare up again.

The second case was similar.

Both cases failed to show sensitivity to synthetic adrenalin.

DEAN, JR.

The Promiscuous Use of the Barbiturates.

Hambourger, W. E. (Cleveland), *J. A. M. A.*, 114:2015, No. 20 (May), 1940.

From data supplied by thirteen hospitals in different sections of the United States, certain outstanding facts concerning barbiturates were evident.

Six hundred and forty-three cases of poisoning in ten years were reported. Forty-seven were fatal. The ratio between suicidal and accidental poisoning was difficult to establish. It was interesting that each new barbiturate enjoyed a prominent place in the statistical table as soon as it became popularized.

Thirteen cases of hypersusceptibility were reported.

Eighty-five cases of addiction were reported. Many of these patients attributed their addiction to the recommendation of a physician. None presented marked withdrawal symptoms when denied the drug.

DEAN, JR.

Books Received

Directory of Medical Specialists. Certified by American Boards, 1939.

Paul Titus, Directing Editor, and J. Stewart Rodman, Associate Editor. xv and 1573 pages, cloth. New York: Columbia University Press, 1940. Price, \$5.00.

This is the official directory of the diplomates certified by the twelve special American boards and one of the two affiliate boards. It lists approximately 14,400 names.

Listing all these groups under one cover is a great convenience, especially to the officers of schools, hospitals and other institutions. The size of the volume alone attests the support which the boards have received in the few years of their existence.

From the standpoint of arrangement and typography, however, this volume is a triumph of obscurantism. Locating the specialty section in the book is no great task but from there on it is a case of the needle in the haystack. White space and type faces are such that the names of towns and villages are more prominent than the names of states, and there being no marginal indices, one is frequently forced to turn several pages before encountering state names. The Columbia University Press might well take a leaf (no pun intended) from the old Otolaryngological Directory in the matter of type faces and arrangements. Fortunately, it is planned to follow this with other editions at short intervals, when we may look forward to a more practical arrangement.

How To Help Your Hearing.

By Louise M. Neuschutz. With a foreword by Walter M. Pitkin. xx and 179 pages, cloth. New York and London: Harper & Brothers, 1940. Price, \$2.50.

This volume is an appeal, popularly written, to the deaf and partly deaf to adjust themselves to their situations and a guide showing them how to make this adjustment, mechanically, socially and psychologically. Individual problems are discussed in a friendly spirit of encouragement and understanding. Especially effective is the plea to the deaf to overcome prejudices against hearing devices and lip-reading and in this respect alone should be a welcome aid to the otologist whose best efforts are so often nullified by the patient's dread of such aids.

Graduate Medical Education.

Report of the Commission on Graduate Medical Education. Cloth, 293 pages. Chicago: University of Chicago Press, 1940.,

This timely work deserves to be carefully studied by everyone engaged in graduate teaching. The Commission on Graduate Medical Education was organized in 1937 in pursuance of a resolution adopted by the Advisory Board for Medical Specialties. Probably no single body at the present time can have a keener appreciation of the requirements of specialized medicine and those who practice it in its various branches than this one.

The correlated experience of the Specialty Boards is a source of first-hand information in this field which has not been previously available and which will have an incalculable influence on American graduate medical teaching in its immediate and future development.

The main sections of the book are devoted to: The Internship, The Residency, Postgraduate Medical Education, and The Specialty Boards.

Hearing and Equilibrium.

By H. Macnaughton-Jones, M.B., B.Ch., B.A.P., R.U.I., *Clinical Assistant, Ear and Throat Department, North London Hospital, London, England.* Cloth, 124 pages with 90 illustrations. The Williams & Wilkins Company, Baltimore, 1940.

A short exposition of the author's conception of these functions. Well illustrated with diagrams and photographs of models built to demonstrate not the anatomy but the mechanics of the ear. Recommended to graduate students and their teachers.

Otology, Rhinology and Laryngology.

By Howard Charles Ballenger, M.D., F.A.C.S., *Assistant Professor of Otolaryngology, Northwestern University School of Medicine, Chicago, Illinois.* Cloth, 295 pages with 90 engravings and 4 color plates. Lea & Febiger, Philadelphia, 1940.

It is our impression that this work is too greatly abridged and abbreviated; one wonders what type of reader will find it adequate to his requirements. Today when the trend of the special societies, the examining boards and the medical schools is sharply opposed to superficial and inadequate training in the specialties the American medical student deserves better fare than he will find here.

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